CardioPerfect Workstation

Service and Advanced installation Manual

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CE 0297

Caution	**US Federal law restricts this device to sale by or on the order of a physician.**

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The information contained in this manual is subject to change without notice.
All changes will be in compliance with regulations governing manufacture of medical equipment.

Document WACPWS/SAI/ENGRev. 00 Version 1.6.0.

User responsibility

This product is designed to perform in conformity with the description thereof contained in this manual and accompanying labels and inserts, when assembled, operated, maintained and repaired in accordance with the instructions provided. A defective product should not be used. Parts that are broken, plainly worn, missing or incomplete, distorted or contaminated should be replaced immediately. Should any repair or replacement become necessary, we recommend that service be performed at the nearest approved service center. The user of the product shall have the sole responsibility for any malfunction, which results from improper use, faulty maintenance, improper repair, damage or alteration by anyone other than Welch Allyn Cardio Control BV or their authorized service personnel.

Accessories

The Welch Allyn Cardio Control BV warranty can only be honored if you use Welch Allyn Cardio Control BV approved accessories and replacement parts.

Caution	Use of accessories other than those recommended by Welch Allyn Cardio Control BV may compromise product performance.

Warranty, Service, and Spare Parts

Warranty

All repairs on products under warranty must be performed or approved by Welch Allyn. Unauthorized repairs will void the warranty. In addition, whether or not covered under warranty, any product repair shall exclusively be performed by Welch Allyn certified service personnel.

Assistance and Parts

If the product fails to function properly or if assistance, service, or spare parts are required please contact the nearest Welch Allyn Technical Support Center.

USA	1-800-535-6663	Canada	1-800-561-8797
Latin America	(+1) 305-669-9591	South Africa	(+27) 11-777-7509
European Call Center	(+353) 469-067-790	Australia	(+61) 2-9638-3000
United Kingdom	(+44) 207-365-6780	Singapore	(+65) 6291-0882
France	(+33) 1-60-09-33-66	Japan	(+81) 3-5212-7391
Germany	(+49) 7477-927-173	China	(+86) 21-6327-9631

Before contacting Welch Allyn it is helpful to attempt to duplicate the problem and to check all accessories to ensure that they are not the cause of the problem.

When calling, please be prepared to provide:

- Product name and model number and complete description of the problem.
- The serial number of your product (if applicable).
- The complete name, address and phone number of your facility.
- For out-of-warranty repairs or spare parts orders, a purchase order (or credit card) number.
- For parts order, the required spare or replacement part number(s).

Repairs

If your product requires warranty, extended warranty, or non-warranty repair service, please call first the nearest Welch Allyn Technical Support Center. A representative will assist you troubleshooting the problem and will make every effort to solve it over the phone, avoiding potential unnecessary return.

In case the return cannot be avoided, the representative will record all necessary information and will provide a Return Material Authorization (RMA) number, as well as the appropriate return address. A Return Material Authorization (RMA) number must be obtained prior to any return.

Note	Welch Allyn does not accept returned products without an RMA.

Packing Instructions

If you have to return goods for service, follow these recommended packing instructions:

- Remove all hoses, cables, sensors, power cords, and ancillary products (as appropriate) before packing, unless you suspect they are associated with the problem.
- Wherever possible use the original shipping carton and packing materials.
- Include a packing list and the Welch Allyn Return Material Authorization (RMA) number.

It is recommended that all returned goods be insured. Claims for loss or damage to the product must be initiated by the sender.

Limited Warranty Statement

Welch Allyn, Inc. warrants that the Welch Allyn CardioPerfect Workstation computer based product you have purchased meets the labeled specifications of the Product and will be free from defects in materials and workmanship that occur within 1 year after the date of purchase. Accessories used with the Product are warranted for 90 days after the date of purchase.

The date of purchase is: 1) the date specified in our records, if you purchased the Product directly from us, 2) the date specified in the warranty registration card that we ask you to send to us, or 3) if you don't return the warranty registration card, 120 days after the date on which the Product was sold to the dealer from whom you bought the Product, as documented in our records.

This warranty does not cover damage caused by: 1) handling during shipping, 2) use or maintenance contrary to labeled instructions, 3) alteration or repair by anyone not authorized by Welch Allyn, and 4) accidents.

If a Product or accessory covered by this warranty is determined to be defective because of defective materials, components, or workmanship, and the warranty claim is made within the warranty period described above, Welch Allyn will, at its discretion, repair or replace the defective Product or accessory free of charge.

You must obtain a return authorization from Welch Allyn to return your Product before you send it to Welch Allyn's designated service center for repair.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. WELCH ALLYN'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF PRODUCTS CONTAINING A DEFECT. WELCH ALLYN IS NOT RESPONSIBLE FOR ANY INDIRECT OR CONSEQUENTIAL DAMAGES RESULTING FROM A PRODUCT DEFECT COVERED BY THE WARRANTY.

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1. Safety Summary

1.1 Introduction

This manual is written for Biomedical or IT engineers to support maintenance of the Welch Allyn CardioPerfect family of devices.

We at Welch Allyn are dedicated to providing safe products to our customers. It is the user's responsibility to follow the established rules of safety as described in this manual for their protection and for the protection of their patients.

The hospital's Biomedical/IT support staff shall require primary skills including disciplines related to maintenance and servicing computer controls/platforms.

Please take note of all safety precautions and warnings provided with the devices before using the devices and the accompanying software.

Warning

The CardioPerfect families of devices are an integral part of a personal computer based diagnostic system. The user shall adhere to warnings in order to ensure safe and reliable performance of the system.

- The personal computer (non-medical electrical equipment) shall be situated outside the patient environment (reference IEC 60601-1-1).
- The personal computer used should adhere to the appropriate safety standard for non-medical electrical equipment (IEC 60950, or national variants), and use of an isolation transformer is recommended.
- Normal isolation transformer does not fulfill IEC601-1-1 standard and it's supplement EEE requirements for transformer unit. To maintain operator and patient safety, consider the requirements of IEC 60601-1-1. Measure the leakage currents to confirm that no electric shock hazard exists.
- The personal computer used should adhere to the appropriate electromagnetic compatibility (EMC) standard for non-medical electrical equipment (CISPR 22/24 - FCC Part 15 - CE, or national variants).

If it is required for the personal computer to be situated within the patient environment, it is the responsibility of the user to ensure that the system provides a level of safety in compliance with IEC 60601-1.

1.2 Symbols

Documentation Symbols		
	WARNING	Indicated conditions or practices that, if continued or not corrected immediately, could lead to illness, injury, or death.
	CAUTION	Indicated conditions or practices that, if continued or not corrected immediately, could damage the equipment.

Shipping, Storing, and Environment Symbols	
	Single use
200x-xx	Expiration date
	Keep away from sunlight
	Temperature Range
	Stacking limits

Certification Symbols	
CE 0297	Meets essential requirements of European Medical Device Directive 3/42/EEC
EC REP	The authorized representative in the European Community

Equipment symbols	
SN	Serial Number
REF	Reference Number
	Type BF Equipment
	Manufacture Date
	Defibrillation-proof type BF applied part

1.3 Servicing the Welch Allyn equipment safely

Before using or servicing the Welch Allyn Equipment, you must read and understand the following safety-related information.

1.3.1. General Warnings

The following warning statements apply to the Welch Allyn CardioPerfect family of devices in general. Warning statements that apply specifically to particular procedures or devices you can find in the corresponding user manuals / device manuals.

- WACP Resting ECG manual and WACP Pro manual
- WACP Stress ECG manual and WACP Pro manual
- WACP Pocket ECG manual and WACP Pro manual
- WACP ABP manual and WACP ABPM6100 manual
- WACP Spiro manual
- WACP MiniHolter manual

⚠	**WARNINGS Related to the environment**
	WARNING: To avoid a possible explosion, do not use the Welch Allyn CardioPerfect family of devices in the presence of flammable anesthetics.
	WARNING: Do not use the Welch Allyn CardioPerfect family of devices in an MRI suite or hyperbaric chamber.
	WARNING: Do not autoclave the Welch Allyn CardioPerfect family of devices or cables.
⚠	**WARNINGS Related to Accessories and other equipment**
	WARNING: For operator and patient safety, peripheral equipment and accessories that can come in direct patient contact must be in compliance with all appropriate safety, EMC, and regulatory requirements. For detailed information on this requirement we refer to the “Guidance and the manufacturer’s declaration” of the user and device manuals.
	WARNING: All signal input and output (I/O) connectors are intended for connection of only devices complying with IEC 60601-1, or other IEC standards (for example, IEC 60950), as appropriate to the device. Connecting additional devices to the Welch Allyn CardioPerfect family of devices may increase chassis or patient leakage currents. To maintain operator and patient safety, consider the requirements of IEC 60601-1-1. Measure the leakage currents to confirm that no electric shock hazard exists.
	WARNING: The Welch Allyn CardioPerfect family of devices has not been designed for use with high-frequency (HF) surgical equipment and does not protect against hazards to the patient.
⚠	**WARNINGS Related to using the Welch Allyn CardioPerfect family of devices**
	WARNING: Satisfactory maintenance procedures must be implemented, or equipment failure and health hazards may result.
	WARNING: Avoid positioning any leads or cables so that they could easily trip someone.

	WARNINGS Related to repairing the Welch Allyn CardioPerfect family of devices
	WARNING: Only qualified service personnel should attempt to repair the device. In case of malfunction, call Technical Support and precisely describe the problem. For phone numbers see page 3.
	WARNING: While under warranty, the device must be serviced only by a Welch Allyn service technician.
	WARNING: Electrostatic discharge (ESD) can damage or destroy electronic components. Handle static-sensitive components only at static safety workstation.
	WARNING: Consider all electrical and electronic components of the monitor as static-sensitive.
	WARNINGS Related to the CardioPerfect ECG recorders
	WARNING: As with any electronic equipment, **Radio Frequency** (RF) interference between the cardiograph and any existing RF transmitting or receiving equipment at the installation site, including electro surgical equipment, should be evaluated before the equipment is operated. Pay special attention to electro surgical equipment and other RF transmitters that are in close proximity to the cardiograph as they are sources of RF interference as they may seriously degrade performance. Like all electronic devices, this cardiograph is susceptible to electrostatic discharge (ESD). Electrostatic discharge typically occurs when electrostatic energy is transferred to the patient, the electrodes, or the cardiograph. ESD may result in ECG artifact that may appear as narrow spikes on the cardiograph display or on the printed report. When ESD occurs, the cardiograph's ECG interpretation may be inconsistent with the physician's interpretation. Welch Allyn Cardio Control BV assumes no liability for failures resulting from RF interference between Welch Allyn Cardio Control BV medical electronics and any radio frequency generating equipment when these levels exceed those established by applicable standards.

	WARNINGS Patient and operational safety notes
	WARNING: Your cardiograph isolates all connections to the patient from electrical ground and all other conductive circuits in the cardiograph. This reduces the possibility of hazardous currents passing from the cardiograph through the patient's heart to ground. To ensure the patient's safety and your own please observe the following: When operating your Welch Allyn System from AC power, be sure it and all other electrical equipment connected to or near the patient are effectively grounded. Use only grounded power cords (three-wire power cords with grounded plugs). Also make sure the outlet accepts the plug and is grounded. ***Never*** adapt a grounded plug to fit an ungrounded outlet by removing the ground prong or ground clip. The patient cable should be routed away from power cords and any other electrical equipment. Failure to do so can result in AC power line frequency interference on the ECG trace.

	The Welch Allyn Cardio Control BV warranty can only be honored if you use Welch Allyn Cardio Control BV approved accessories and replacement parts. See Maintaining the Cardiograph for more information.

1.3.2. General Cautions

The following caution statements apply to the Welch Allyn CardioPerfect family of devices in general. Caution statements that apply specifically to particular procedures or devices you can find in the corresponding user manuals / device manuals:

- WACP Resting ECG manual and WACP Pro manual
- WACP Stress ECG manual and WACP Pro manual
- WACP Pocket ECG manual and WACP Pro manual
- WACP ABP manual and WACP ABPM6100 manual
- WACP Spiro manual
- WACP MiniHolter manual

Caution statements indicate conditions or practices that could damage the equipment or other property.

	General Cautions
	Caution: Use of accessories other than those recommended by Welch Allyn Cardio Control BV may compromise product performance.
	Caution: When removing the device from storage, allow it to thermally stabilize to the surrounding environmental conditions before using it.
	Caution: To prevent possible damage to the device, do not use sharp or hard objects to press keys. Only use fingertips.
	Caution: Do not pull or stretch the cables. Doing so could result in mechanical or electrical failures. Form the cable into a loose loop before storing.
	Caution: Portable and mobile RF communications can affect the performance of the device.

2. Purpose and Scope

The service manual is a reference for periodic preventive maintenance and corrective service procedures.

Corrective service is supported to the level of field-replaceable parts.

	Note	Opening and repair of the Welch Allyn CardioPerfect family of devices can only be performed by certified and qualified service personnel at an authorized Welch Allyn Service center.
	Caution	No component-level repair of circuit boards and subassemblies is supported. Use only the repair procedures described in the manual.
	Warning	When performing a service procedure, follow the instructions exactly as presented in this manual. Failure to do so could damage the equipment, invalidate the product warranty, and lead to serious personal injury.

This guide provides troubleshooting, installation and configuring information and instructions for functional testing and performance verification.

2.1 Service Options

2.1.1. Warranty Service

All repairs on products under warranty must be performed and/or approved by Welch Allyn. Refer all warranty service to Welch Allyn Factory Service or another authorized Welch Allyn Service Center. Obtain an RMA number for all returns to Welch Allyn Factory Service – see Returning Products.

	Caution	Unauthorized repairs will void the product warranty.

2.1.2. Non Warranty Service

Welch Allyn Factory Service and authorized Service Centers support non-warranty repairs. Contact any Welch Allyn regional service center for pricing and service options.

Welch Allyn offers modular repair parts for sale to support non-warranty service. This service must be performed only by qualified end-user biomedical/clinical engineers using this service / installation manual.

2.1.3. Technical Support Services

Welch Allyn offers the following technical support services:

- Telephone support
- Loaner equipment
- Service Agreements
- Replacement service parts
- Factory service

For information on any of these services, contact Welch Allyn at the numbers listed on page 3.

2.1.4. Returning products

To return a product for service, contact Welch Allyn Technical Support and request a Return Material Authorization (RMA) number.

Note	Welch Allyn does not accept returned products without an RMA.

When requesting an RMA, please have the following information available:

- Product name, model number and serial number.
- A complete return shipping address, including a contact name and phone number; include any special shipping instructions.
- A purchase-order number or credit card number if the product is not covered by warranty.
- A full description of the problem or service request.

To ship the unit, please observe these packing guidelines:

- Remove from the package all hoses, connectors, cables, sensors, power cords and other ancillary products and equipment, except those items that might be associated with the problem.
- Use the original shipping carton and packing materials, or as close an approximation as possible.
- Include a packing list.
- Write the Welch Allyn RMA number with the Welch Allyn address on the outside of the shipping carton.

2.2 Accessories

2.2.1 Resting ECG configuration and Accessories

Basic Resting ECG configurations consist of	
PRO-60023	PRO USB Interface Cable 2 meters
RE-PC-IEC-BAN	Patient Cable for PRO ECG Recorder, banana, Euro coded
RE-ELEC	Disposable Electrodes for Banana Cable (50x)

Accessories Resting ECG

RE-PC-IEC-BAN	Patient cable Pro, banana, Euro coded
RE-PC-AHA-BAN	Patient cable Pro, banana, AHA coded
PRO-60024	PC interface cable ProLink length 3 meter
PRO-60025	PC interface cable ProLink length 5 meter
RE-SW-MEANS	Means Automatic Rest-ECG interpretation
RE-PC-IEC-BANL	Patient Cable PRO, X Long, banana, Euro coded
RE-PC-AHA-BANL	Patient Cable PRO, X Long, banana, AHA coded
RE-ELEC-SET	Electrode set (6 cups,4 clamps, ECG gel)
RE-GEL	One bottle of Electrodes Gel (240 Grams)
RE-GEL-12	Box of Electrodes Gel (12 bottles)
RE-ELEC-CUP	Welch Cup Electrode
RE-ELEC-KID	Pediatric Welch Cup Electrodes
RE-ELEC-CLP	Clamp Electrode Set
RE-ELEC	Disposable Electrodes for Banana Cable (50x)
RE-ELEC-20	Disposable Electrodes for Banana Cable (1000x)

45008-0000	Resting Tab Electrodes (box of 1000) 100ECG
58581-0000	Universal Electrode Adapters (for use with Resting Tab electrodes)
PRO-60019	PRO Recorder Battery Pack
PRO-60039	PRO Recorder Battery Charger

2.2.2 Exercise ECG configuration and Accessories

Basic Exercise ECG configurations consist of

PRO-60024	PC interface cable ProLink length 3 meter
SE-PRO-BLT	Belt for PRO Recorder Pouch
SE-PRO-PCH	Pouch for PRO Recorder

Accessories Exercise ECG

SE-PC-IEC-PUSH	Patient Cable PRO, pushbutton, Euro coded
SE-PC-IEC-PSHL	Patient Cable PRO, pushbutton, X Long, Euro coded
SE-PC-AHA-PSHL	Patient Cable PRO, pushbutton, X Long, AHA coded
SE-PC-IEC-CLIP	Patient Cable PRO, Clip ending, Euro coded
SE-PC-AHA-CLIP	Patient Cable PRO, Clip ending, AHA coded
SE-PC-IEC-CLPL	Patient Cable PRO, Clip ending, X Long, Euro coded
PRO-60023	PRO USB Interface Cable 2 meters
PRO-60025	PRO USB Interface Cable 5 meters
SE-SKN-PREP	Sand Paper, Skin Prep (36 rolls)
SE-ELEC	Disposable Exercise ECG Electrodes (Clip/Push) (25x)
SE-ELEC-40	Disposable Exercise ECG Electrodes (Clip/Push) (1000x)

2.2.3 Recommended Service Intervals Resting / Exercise ECG

Interval or Condition	Action Recommended	Procedure
Every 6-24 months (per hospital procedure)	Complete Functional test	Functional verification ECG recorder
Unit has been dropped or otherwise damaged	Complete Functional test	Functional verification ECG recorder
Unit malfunctioning	Complete Functional test	Functional verification ECG recorder
Unit does not pass Functional verification	Troubleshooting and repair followed by functional test	Troubleshooting ECG recorder
		Troubleshooting Software module
		Troubleshooting Exercise device see the service manual of the exercise device*
		Functional verification ECG recorder
	Return to Authorized service center	Returning products

* Only applicable for Exercise ECG

2.2.4 MiniHolter Event ECG configuration and Accessories

Note: *Not sold in US; Product is discontinued.*

Basic configuration MiniHolter Event ECG

REC-RECORDER	MiniHolter Event ECG Recorder
REC-BELT	Standard Adjustable Belt
REC-CC	MiniHolter Carrying Case
REC-ELEC-VLC	Chest Electrodes 25 pieces
REC-MC-90	90 Minute Memory Card
REC-PC-2	Dual Lead Patient Cable
REC-SW	WACP Workstation Event ECG Software

Accessories MiniHolter Event ECG

REC-BELT-W	Wide Adjustable Belt
REC-ELEC-NF	Wrist Electrodes 12 pieces
REC-ELEC-NF10	Wrist Electrodes 120 pieces (10 bags)
REC-ELEC-VL10	Chest Electrodes 250 pieces (10 bags)
REC-CR-USB	External Card Reader (USB)

2.2.5 Recommended Service Intervals MiniHolter Event ECG

Interval or Condition	Action Recommended	Procedure
Every 6-24 months (per hospital procedure)	Complete Functional test	Functional verification MiniHolter
Unit has been dropped or otherwise damaged	Complete Functional test	Functional verification MiniHolter
Unit malfunctioning	Complete Functional test	Functional verification MiniHolter
Unit does not pass Functional verification	Troubleshooting and repair followed by functional test	Troubleshooting MiniHolter
		Functional verification MiniHolter
	Return to Authorized service center	Returning products

2.2.6 Pocket ECG configuration and Accessories

Basic configuration Pocket ECG

PE-PROLINK	Pocket PC interface cable
RE-SW-ECG	
RE-PC-IEC-BAN	Patient cable Pro, banana, Euro coded
RE-ELEC	Disposable Electrodes for Banana Cable (50x)
PRO-60019	PRO Recorder Battery Pack
PRO-60039	PRO Recorder Battery Charger

Accessories Pocket ECG

PRO-60041	Power cord European
PRO-60042	Power cord UK

2.2.7 Ambulatory Blood Pressure configuration and Accessories

Basic configuration Ambulatory Blood Pressure

ABPM-6100	Ambulatory Blood Pressure Device
6100-24	ABPM PC Interface Cable
6100-21	ABPM Pouch
6100-12	ABPM Cuff, Adult (254-343mm)
6100-22	ABPM Shoulder Strap
6100-23	ABPM Belt

Accessories Ambulatory Blood Pressure

5100-42E	Patient Diary English (Set of 50)
5100-44	Cuff Anchoring Pads (Set of 50)
6100-10	ABPM Cuff, Pediatric (160-218mm)
6100-11	ABPM Cuff, Small Adult (211-266mm)
6100-13	ABPM Cuff, Adult Plus (270-420mm)
6100-14	ABPM Cuff, Large Adult (343-482mm)
6100-25	ABPM Calibration Y-Fitting

2.2.8 Recommended Service Intervals Ambulatory Blood Pressure

Interval or Condition	Action Recommended	Procedure
Every 6-24 months (per hospital procedure)	Complete Functional test	Functional verification ABP device
Unit has been dropped or otherwise damaged	Complete Functional test	Functional verification ABP device
Unit malfunctioning	Complete Functional test	Functional verification ABP device
Unit does not pass Functional verification	Troubleshooting and repair followed by functional test	Troubleshooting ABP device
		Functional verification ABP device
	Return to Authorized service center	Returning products

2.2.9 Spirometry configuration and Accessories

Basic configuration Spirometry

703414	Sensor Spirometer USB Kit
703415	Pressure Tubing
703419	Disposable Flow Transducer (order quantity 100, package includes Linearization file on CD)
58550-0000	Nose Clip
703480	3 Liter Calibration Syringe

2.2.10 Ordering Information for Replacement Parts SpiroPerfect

The following parts must be replaced as noted:

- Flow transducers & nose clips – Replace for each new patient.
- Pressure tubing – Replace when dirty.
- Sensor – Replace when faulty.

To order parts, call the Welch Allyn Technical Support Center.

⚠	**WARNING**	Discard all Spirometry components according to local regulations.

Use of components other than those recommended by Welch Allyn Cardio Control BV may compromise product performance. The Welch Allyn Cardio Control BV warranty can only be honored if you use Welch Allyn Cardio Control BV approved components and replacement parts.

Item		Part Numbers	Order Quantities
Disposable Flow Transducer (CPWS,CP200) Package includes Linearization file on CD		703418 703419	25 pk 100 pk
Pressure Tubing (CPWS, CP200, 2m)		703415	1
Sensor Spirometer USB Kit		703554	1
Nose Clip		58550-0000	1

2.2.11 Ordering Information for Replacement Parts SpiroPerfect VCT 400

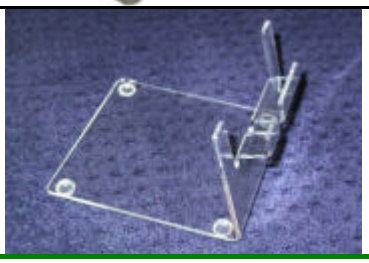
The following parts must be replaced as noted:

- Cardboard mouthpiece & nose clips – Replace for each new patient.
- Sensor – Replace when faulty.
- Sensor Holder - Replace when broken.
- Transparent Holder - Replace when broken.

To order parts, call the Welch Allyn Technical Support Center.

⚠	**WARNING**	Discard all Spirometry components according to local regulations.

Use of components other than those recommended by Welch Allyn Cardio Control BV may compromise product performance. The Welch Allyn Cardio Control BV warranty can only be honored if you use Welch Allyn Cardio Control BV approved components and replacement parts.

Item		Part Numbers	Order Quantities
Cardboard mouthpiece		SP-M-100 SP-MC-1000	 100 pk 1000 pk
Welch Allyn SpiroPerfect VCT 400 sensor		SP-SENSOR	1
SpiroPerfect VCT 400 Sensor Holder		SP-SENS-HLD	1
SpiroPerfect VCT 400 Transparent Holder		SP-HLD-TRANSP	1

2.2.12 Recommended Service Intervals Spirometry

The Spirometer sensor needs little maintenance to stay in good working condition. Change the flow transducer for each patient. Check periodically for damages. Check that all connections are properly aligned and tight. Visually check the pressure tubing for leaks and kinks. Check for irreversible bending or compression of the pressure tubing between flow transducers and device.

Ensure Spirometer is calibrated and that proper linearization code is used. The linearization code can be found on the Labeling that came with your flow transducer package. For proper installation, refer to the Calibration chapter manual WACP Spiro Replace sensor when faulty.

Avoid placing Spirometer and any of its components in direct sunlight or in a dusty environment.

⚠	**CAUTION**	To make reliable recordings, calibrate the sensor on a daily basis. Keep track of the calibrations in the calibration log.

Interval or Condition	Action Recommended	Procedure
Unit has been dropped or otherwise damaged	Recalibrate	Calibration procedure WACP Spiro manual

Unit malfunctioning	Recalibrate	Calibration procedure WACP Spiro manual
Unit does not pass calibration	Troubleshooting and repair followed by functional test	Troubleshooting Spirometer
	Return to Authorized service center	Returning products

3. Backing up the database

3.1 Backup

In a computer environment, there is always a possibility that something goes wrong: hard disks can crash, databases can get corrupted, system software can fail and users can make mistakes. When one of these events takes place, database tables may be lost or corrupted. To limit the possible risk of data loss you should back up your files regularly.

Full backup
With the Administrator tool you can make a full backup your database. During the backup, copies of the database and the transaction log are made. These copies can be used to restore the database after the database has become corrupt or is lost during a catastrophic event. After the backup the transaction log is truncated.

Manually/Automatically
You can backup a database in two different ways:

- **Manually**: The simplest way to perform a backup of the database. You can manually backup the database at any time you want.
- **Automatically**: A backup or a series of backups at a fixed date and time. When you want to backup the database automatically you need to schedule a backup.

To configure the backup device:

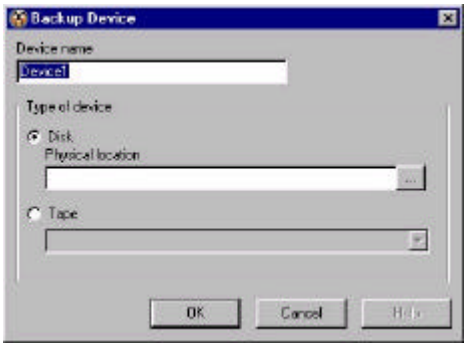
- In the Administration Tool select **Database Administration**.

3.2 Create a backup device

Before you can make a backup of the database, you need to create a backup device. A backup device is a place where you store the backup. It can be a file on your hard disk or network drive, or a tape. We advise you to create a backup device on a different hard disk than the one that contains the database. If you do not do this, you run the risk of losing both your database and your backup if your computer crashes.

To create a backup device:

1. Click **Backup database**.
2. Click the **Add device** button. The **Backup device** dialog box is displayed.



3. Enter the name of the backup device.
4. Select the device type.

If you select...	Then...
Disk	Select the location where the backup is created and enter a filename. When you select a network drive, make sure you have the proper permissions to access the backup directory and file.
Tape	Select the tape and enter a filename. Make sure that the tape driver is connected to the computer that runs SQL server.

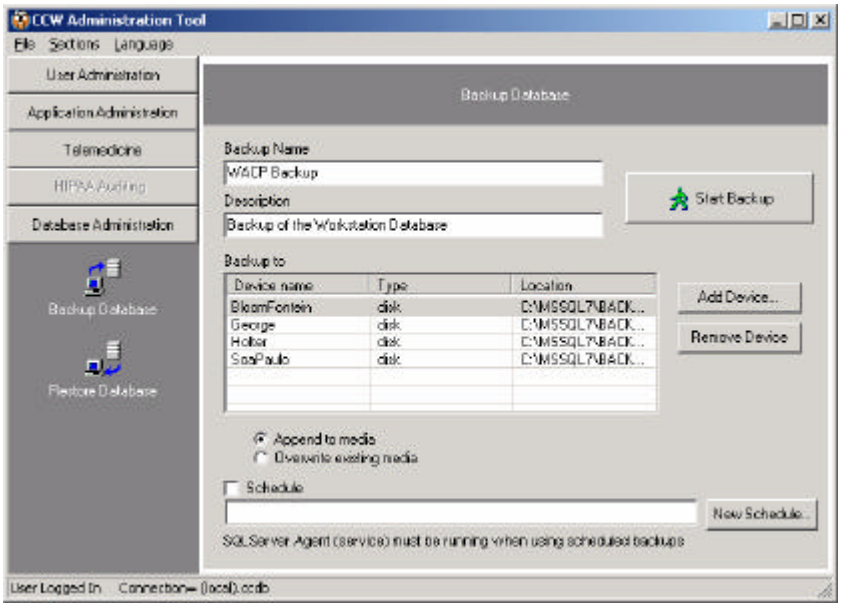
3.3 Make a manual backup

The simplest way to create a backup is to create one manually. You can do this anytime you want; end users do not have to log out.

Before you can make a backup, you need to have created a backup device.

To make a manual backup:

1. Select **Backup database**.



2. Enter a name and a description for the backup.
3. Select the backup device to which you want to backup the database.
4. Select the type of backup that you want to make.

If you select...	Then...
Append to media	The backup is added to the already existing backup on the selected backup device.
Overwrite existing media	The existing backup overwrites the already existing backup. The existing backup is lost.

5. Click the **Start Backup** button to start the backup process.

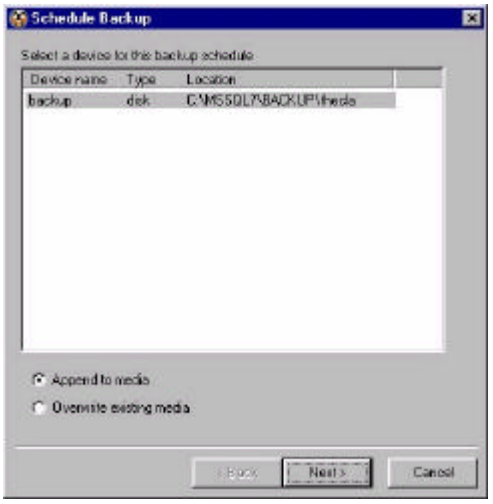
3.4 Schedule an automatic backup

If you want to make automatic backups of the database, you need to schedule the times at which the backup is made. You can schedule a single backup, or a recurring backup.

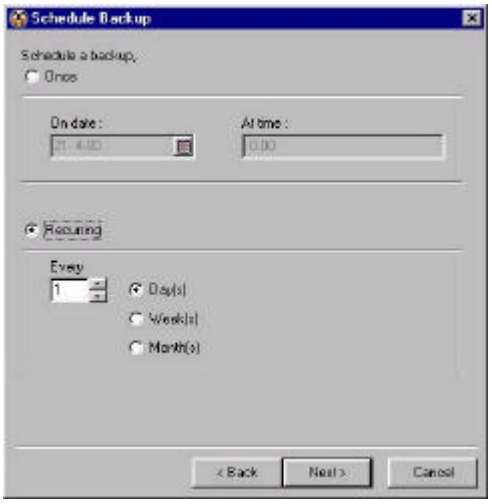
Important: Make sure that the computer is switched on at the time you scheduled the backup. Also ensure that SQL Server Agent is running.

To schedule an automatic backup:

1. Click **Backup database**.
2. Select the **Schedule** check box and click the **Change** button. The **Schedule backup** dialog box is displayed.

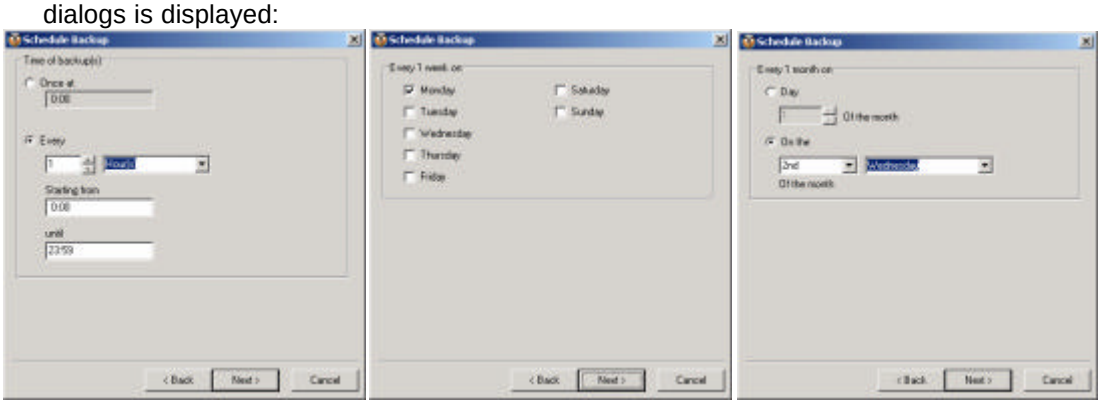


3. Select the backup device and backup type you want to use and click **Next**.
4. Select whether you want to schedule a single backup or a recurring number of backups.



If you select...	Then...
Once	Enter the date and time at which the backup must be made and click **Next**.
Recurrent	Enter the day or month at which the backup must be made. Enter the time at which the backup must be made. Click **Next**.

5. If you scheduled a recurrent backup, depending on which option was selected one of these dialogs is displayed:



Days Weeks Months

Enter the preferred schedule in the next steps. Click **Next**.

6. A summary shows the details of the backup schedule. Verify that this information is correct and click **OK**.

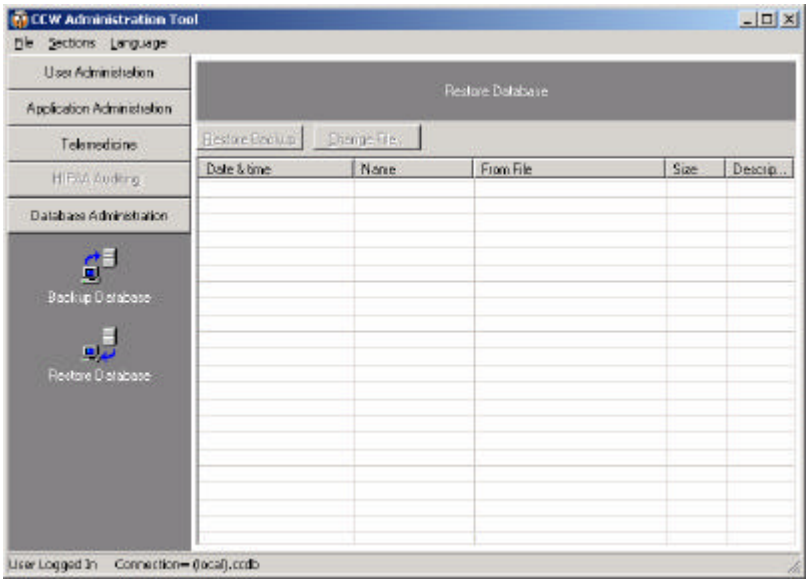
Restore the database
Restoring is the process of recovering a damaged, corrupt or missing database. Several situations can arise that might require the recovery of the database.

Problem evaluation
Prior to the recovery of the database you should evaluate the situation very carefully. What is wrong with the database and what is the date of the most recent database backup?

Important: When performing a database restore you can only recover the database to the point of the latest backup. Any changes made to the database after the last backup will be lost.

To restore a database:

1. Make sure that all users are logged out. You cannot restore the database while it is being used.
2. Under **Database tools**, click **Restore database**.



3. Select the backup that you want to restore. If you have moved your backup files to a different location, use the **Change File** button to locate the backup files.
4. Click on the **Restore** button. A warning is displayed.
5. Click **Yes** to start with the restore process. When the restore process was successful, a message is displayed.

3.5 Index tuning wizard

The index tuning wizard should be used at least quarterly, for hospitals more frequently.

If the full recovery is not needed, then full recovery should be set to **Simple**.

4. Functional Verification Overview

This section describes the procedure for a complete functional test to support recommended preventive-maintenance schedules.

Functional verification does not require opening the device case.
Whenever the device is serviced or problems are suspected, Welch Allyn recommends a Functional Check.

	WARNING Only qualified service personnel should perform a full functional verification procedure.

	WARNING Only qualified service personnel should perform leakage current test.
	Refer to the Electrical Safety Analyzer manual for complete details on set-up and use for testing: • Earth Leakage • Chassis Leakage • Patient Leakage

4.1 Equipment required

Commercially Available General-purpose/Medical Test Equipment	
Item	**Description**
ECG simulator	Standard 12 lead ECG simulator
Computer	PIII or better, Welch Allyn CardioPerfect software version 1.5.0 or higher installed
DVM	Digital Volt Meter
Recollect Card Reader	Reader for the Recollect SRAM card
Electrical safety tester	Commercially Available General-purpose/Medical Test Equipment

4.2 Functional Verification ECG Recorder

A checklist of the functional tests is provided on Checklist and Test Results Form I. It is recommended that you print a copy of the checklist each time you perform the functional verification procedure, so you can record and save the test results. If the ECG recorder ever requires service, the records of test results often facilitate troubleshooting.

Verify continued electrical safety of the Welch Allyn System, using IEC 60601-1 or ANSI/AAMI ES1 methods and limits. Test for the following:

- Patient Leakage current
- Chassis leakage current
- Earth leakage current

4.2.1. Patient Cable Verification

1. The Patient cable should be inspected for any cracks, exposed wires or other damage
2. Each cable needs to be individual measured to ensure the correct impedance

Cable					
AHA	**EUR**	**Pin configuration Pro patient cable**	**Expected impedance (Ohm)**	**Pin configuration MD patient cable**	**Expected impedance (Ohm)**
LA	L	1	0 Ω	10	10 KΩ
RA	R	2	0 Ω	9	10 KΩ
LL	F	3	0 Ω	11	10 KΩ
V1	C1	4	0 Ω	12	10 KΩ
V2	C2	5	0 Ω	1	10 KΩ
V3	C3	6	0 Ω	2	10 KΩ
V4	C4	7	0 Ω	3	10 KΩ
V5	C5	8	0 Ω	4	10 KΩ
V6	C6	9	0 Ω	5	10 KΩ
RL	N	10	0 Ω	14	10 KΩ

4.2.2. Computer Interface Verification

The interface between the computer and the ECG recorder depends on the type of recorder and the connection used on the computer. In the following table you find all possible configurations.

Recorder type	Part number	Computer connection	Interface cable	Part number
Pro recorder	SE-PRO-EUR-600	USB	ProLink	PRO-60023 (2 meter) PRO-60024 (3 meter) PRO-60025 (5 meter)
MD/Portable recorder	Obsolete	USB	USB UniLink*	RE-LINK-USB (Resting ECG only) SE-LINK-USB (Stress and Rest ECG)
		RS232	Serial UniLink*	RE-LINK-SER (Resting ECG only)
		PCI slot	CPCOM PCI*	Obsolete
		PCMCIA slot	CPCOM PCMCIA*	Obsolete
		ISA slot	CPCOM ISA*	Obsolete

***The MD and Portable recorder requires additional an optical fiber**
Part number SE-FIBER-05 (5 meter)
Part number SE-FIBER-10 (10 meter)

1 The ProLink / UniLink Interface cable should be inspected for any cracks, exposed wires or other damage.
2 The optical fiber should be inspected for any cracks or other damage.
3 Follow the next procedure to verify if the ECG recorder in combination with the computer interface is working:
4 Connect the patient cable to the ECG simulator
5 Set the ECG simulator on a specific simulation for example 90 BPM
6 Connect the patient cable to the ECG recorder
7 Connect the Computer Interface cable to the computer and the ECG recorder
8 Start the Welch Allyn CardioPerfect Software
9 Create a new test patient or select a previous created test patient[1].
10 Start a Resting ECG and follow the instructions on the screen[2].
11 You should see the ECG traces on the computer screen[3]
12 Monitor the ECG traces for approximately one minute[3]
13 Record a Resting ECG[2]
14 If you pass the complete procedure without problems the communication is working.

[1] For further instructions see WACP Workstation manual Section 2: Working with patients.
[2] For further instructions see WACP Resting ECG manual.
[3] In case of problems/errors try to resolve it with the use of the troubleshooting guide.

4.2.3. Resting ECG Results Verification

To verify the ECG results you can perform the following procedure:

a. Select the ECG on the screen which you recorded.
b. Print the following print formats[2].
   - 4x3, 25 mm/s
   - Measurements
c. Manually measure the following parameters and compare them with the computer measurements. You can fill in the test results on Checklist and Test Results Form I.
   - Heart rate ± 1BPM
   - Height Calibration pulse
   - R wave in Lead I,V1,V2,V3,V4,V5 and V6

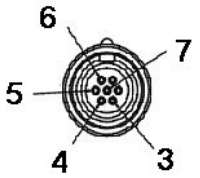
4.3 Functional Verification MiniHolter

Note: MiniHolter not sold in the US.

A checklist of the functional tests is provided at the end of this manual (Checklist and Test Results Form II.). It is recommended that you print a copy of the checklist each time you perform the functional verification procedure, so you can record and save the test results. If the MiniHolter ever requires service, the records of test results often facilitate troubleshooting.

4.3.1. Patient Cable Verification

1. The Patient cable should be inspected for any cracks, exposed wires or other damage.
2. Each lead needs to be individual measured to ensure the correct impedance.

Cable					
Color	**Channel**	**Pin configuration Dual lead patient cable**	**Expected impedance (Ohm)**	**Pin configuration Single lead patient cable**	**Expected impedance (Ohm)**
Red	**1 +**	**4**	0 Ω	**4**	0 Ω
Black	**1 -**	**3**	0 Ω	**3**	0 Ω
White	**2 +**	**6**	0 Ω	N/A	N/A
Green	**2 -**	**7**	0 Ω	N/A	N/A

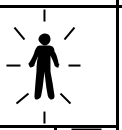
Connect a dual lead patient cable to the ECG simulator following the schematic below:

Color	Channel	Simulator	
		AHA	**EUR**
Red	**1 +**	**RA**	**R**
Black	**1 -**	**RL**	**N**
White	**2 +**	**LA**	**L**
Green	**2 -**	**LL**	**F**

Set the ECG simulator on a specific simulation for example 90 BPM.

4.3.2. Checkpoints MiniHolter

Place the batteries in the MiniHolter and check the following points:

Test	Condition	Expected result		Pass	Fail	N/A
1	Press the record button briefly	Correct time is displayed. The display switches off automatically after a few seconds				
2	If test 1 fails correct the time[o], remove the batteries and repeat test 1after 6 hours	Correct time is displayed[1]. The display switches off automatically after a few seconds				
3	Format a Recollect memory card with the Welch Allyn Recollect Card Format tool[2]. Fit the card in the MiniHolter and press the record button briefly	The Memory Card symbol is flashing and the MiniHolter starts beeping				
4	Configure the memory card[3] in the Welch Allyn CardioPerfect software for a 2 channel test. Fit the card in the MiniHolter and press the record button briefly	The patient symbol is flashing and the Memory card gives the indication how many recordings can be stored				
5	Switch the ECG simulator on, connect the patient cable to the MiniHolter and press the record button briefly	The patient symbol is not flashing Heartbeat indicator will appear on the display. On every heartbeat there is a beep signal				
6	Press the Record button briefly	The beep signal on every heartbeat will stop. The looping symbol will appear with the 2 in the middle				
7	Press the Record button till a beep signal sounds and the green LED on the front of the Recollect will go on	The Recollect will record an ECG and will store this on the Recollect Memory card. After the set recording duration the Green LED will switch off and the indication on how many recordings can be stored will be one less then on point 4				
8	Unplug the green electrode (2-) from the ECG simulator and shortly remove a battery from the MiniHolter	The patient symbol is flashing and the number 2 is on the display indicating that the problem is related to channel 2				
9	Unplug the black electrode (1-) from the ECG simulator and shortly remove a battery from the MiniHolter	The patient symbol is flashing 2				

[o] For further instructions see WACP MiniHolter manual
[1] If the correct time is not displayed the MiniHolter needs to be send in for service to a Welch Allyn Service center
[2] For further instructions see WACP MiniHolter manual
[3] For further instructions see WACP MiniHolter manual

4.3.3. MiniHolter ECG verification

Remove the card from the Recollect and import the contents of this memory card into the Welch Allyn CardioPerfect Software, for further instructions see WACP MiniHolter manual.

Print the recorded MiniHolter ECG and determine the heart rate

4.4 Functional verification ABP device

A checklist of the functional tests is provided at the end of this manual (Checklist and Test Results Form III.). It is recommended that you print a copy of the checklist each time you perform the functional verification procedure, so you can record and save the test results. If the ABP device ever requires service, the records of test results often facilitate troubleshooting.

4.4.1. Visual inspection

The following inspections of the unit should be performed on a regular basis:

1. The housing should be inspected for any visual damage.
   Do not remove any covers or break the warranty.
2. Interface cable
3. Cuff and connecting tube

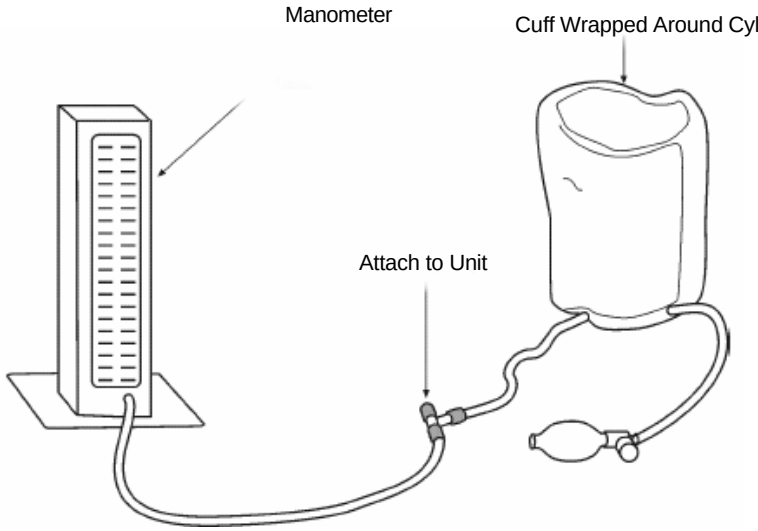
If any signs of damage are detected, do not use the ABPM monitor. It should be sent to an authorized Welch Allyn service center. See the Service and Warranty section of this manual for a list of authorized Welch Allyn service centers.

4.4.2. Calibration verification ABP Device

The ABP device needs to be set in to a manometer mode before you can perform the calibration verification. To set the ABP device in the manometer mode use the following procedure depending on the type of Device:

ABPM 6100	❖ With the ABPM 6100 unit already powered up, remove one of the AA batteries from the battery compartment. Then immediately replace the battery back in its proper orientation, which will result in the unit to start the power up cycle. ❖ While the LCD is displaying dashes, press and hold down the Start/Stop button. The unit will display the software version, the battery voltage, followed by a click as the valves are closed. When the process is finished, a pressure value will be displayed on the LCD and the unit is ready to have the calibration checked.
ABP Perfect	❖ Press and hold the PROTOCOL and DAY/NIGHT keys at the same time and then briefly operate the ON/OFF key to switch on the unit. The display will show “8888” for approximately 8 seconds. The equipment will then switch to manometer mode and show “P.000” ❖ Press the Start Key briefly so that the unit pumps for a short time. The pump runs for as long as the START key is held down.

1. Disconnect the cuff assembly from the unit.
2. Attach the appropriate end of a Y-connector to the monitor. Attach a cuff to the appropriate end of the Y-connector, and wrap around a suitably sized can or bottle. This acts as the reservoir for the unit. Connect the third leg of the Y-connector to a high quality, known pressure standard. Refer to the following calibration figure for a sketch of the test set up.
3. Pressurize gauge to 300 mmHg and compare against pressure standard (see following calibration figure). If the unit does not meet the required calibration, the unit needs to be returned to Welch Allyn for calibration or repair.
4. Bleed pressure down no faster than 10 mmHg per second, stopping to check the pressure at 250, 200, 150, 100, and 50 mmHg. Refer to the notes that follow for tolerances.
5. When finished on the
   - ABPM 6100 remove one of the AA batteries from the battery compartment. Then immediately replace the battery back in its proper orientation, which will cause the unit to start the power up cycle.
   - ABP Perfect switches it OFF and ON to return to normal mode.



Note: Your ability to measure the accuracy of the ABPM 6100 / ABP Perfect depends upon the sensitivity of the pressure standard you use for the calibration procedure.

- If using a manometer (mercury column or aneroid gauge) rated at ± 3.0 mm Hg, you will be able to determine the accuracy of the unit being tested to within ± 6.0 mm Hg.
- If using a device (e.g., digital pressure standard) rated at ± 1.0 mm Hg, you will be able to determine the accuracy of the unit being tested to within ± 4.0 mm Hg.

- Welch Allyn recommends using the most sensitive pressure standard possible when performing calibration checks. A Setra Pressure Meter 2270-01, which is calibrated for ± 0.1 mm Hg, works well for this application. In the Federal Republic of Germany: In accordance with Med Betreib, the ABPM must be returned every 2 years to instrumentation control for calibration certification.

4.4.3. Overpressure verification ABP device

The ABP device should deflate the pressure at a pressure higher then > 300 mmHg + 10 %. To verify this use the following procedure.

1. Set the ABP device in the manometer mode.
2. Pressurize gauge to 300 mmHg + 10%, the unit should deflate the pressure.

4.4.4. Leakage test

The pressure on the ABP device may deflate with a maximum of 4 mmHg per minute. To verify this use the following procedure.

1. Set the ABP device in the manometer mode.
2. Pressurize gauge to approximately 150 mmHg
3. Note the pressure reading
4. Wait for 1 minute and note the pressure reading again. The difference between the two readings should be less then 4 mmHg

4.4.5. Pressure release

As a safety precaution the device should release the pressure when it takes longer then 3 minutes to measure the blood pressure. To verify this use the following procedure.

1. Set the ABP device in the manometer mode.
2. Pressurize gauge to approximately 150 mmHg
3. After less then 3 minutes the unit should deflate the pressure to 0 mmHg.

4.5 Functional verification Spirometer

Functional verification can be performed by using the Calibration procedure described in the WACP Spiro manual.

Verify continued electrical safety of the Welch Allyn System, using IEC 60601-1 or ANSI/AAMI ES1 methods and limits. Test for the following:

- Patient Leakage current
- Chassis leakage current
- Earth leakage current

4.5.1. Maintenance Welch Allyn SpiroPerfect

The Spirometer sensor needs little maintenance to stay in good working condition. Change the flow transducer for each patient. Check periodically for damages. Check that all connections are properly aligned and tight. Visually check the pressure tubing for leaks and kinks. Check for irreversible bending or compression of the pressure tubing between flow transducers and device.

Ensure Spirometer is calibrated and that proper linearization file is used. The linearization file can be found on the Linearization Calibration CD that came with your flow transducer package. For proper installation, refer to chapter 7 of the WACP Spiro manual. Replace sensor when faulty.

Avoid placing Spirometer and any of its components in direct sunlight or in a dusty environment.

⚠	**CAUTION**	To make reliable recordings, calibrate the sensor on a daily basis. Keep track of the calibrations in the calibration log.

4.5.2. Cleaning the Welch Allyn SpiroPerfect

You cannot clean the Spirometer or any of its components. If you choose to clean the calibration syringe, wipe its external surfaces as needed with a cloth dampened with water only.

⚠	**WARNING**	Satisfactory maintenance procedures must be implemented, or equipment failure and health hazards may result. Only qualified service personnel should repair the equipment.
	WARNING	To prevent cross-contamination, do not try to clean the flow transducers and nose clips. Discard these items after a single patient use. Wear rubber gloves when replacing flow transducers, and wash hands after touching them.

⚠	**CAUTION**	**Do not** clean the pressure tubing or sensor. Trapped moisture could affect accuracy. **Replace** the pressure tubing when it becomes dirty. **Recalibrate** after replacement. **Replace** the sensor when it becomes faulty. **Ordering Information** for Replacement Parts see Section 2. **Do not** immerse any part of the Spirometer into a cleaning liquid or sterilize it with hot water, steam, or air. **Do not** use aromatic hydrocarbons, rubbing alcohol, or solvents for cleaning the Spirometer.

4.6 Maintenance SpiroPerfect VCT400

The SpiroPerfect VCT400 sensor needs little maintenance to stay in good working condition. Only clean and sterilize it. Change the cardboard mouthpiece for each patient. Check periodically for damages. Check that all connections are properly aligned and tight. Visually check the following:

- The PC connection cables should be inspected for any cracks, exposed wires or other damage.
- The monitor itself should be visibly inspected for any signs of damage.
- SpiroPerfect sensor should be inspected for any visual damage.
- Do not remove any covers or break the warranty seal while inspecting the unit.

Ensure Spirometer is calibrated for further information refers to the WACP Spiro manual.

⚠	**CAUTION**	To make reliable recordings, calibrate the sensor on a daily basis. Keep track of the calibrations in the calibration log.

4.6.1. Cleaning and Disinfection Procedure SpiroPerfect VCT 400

Mouthpiece

The cardboard mouthpiece is for single patient use only. Discard it after the test.

Housing

Clean the outside of the housing with a non-aggressive cleaning agent daily.

Holder and sensor

Clean and disinfect the holder and sensor after each test.

Cleaning:

1. Use an ultrasound bath with a household cleaning agent.
2. Rinse thoroughly with distilled water afterwards.
3. Let it dry.

Note: Clean holder and sensor immediately after a test. It will be more difficult to clean when saliva dries on the sensor.

Disinfection

Leave the sensor and holder emerged in Ethyl alcohol (max. 70%) for 5 to 10 minutes (if it is left emerged for a longer period, the glue inside the sensor may dissolve).

⚠	**CAUTION**	**Never use Isopropyl alcohol**, this dissolves the glue in the sensor. The use of **"Spiritus Ketonatus Dilutus**" (70%) is recommended. This alcohol solution consists of 70% ethanol and 0.5% methylethylketon. Other recommended disinfection substances are: (best used in an ultrasound bath): • Secusept forte in a concentration of 1.5% • Lysoformin 3000 • Descogen After disinfection, rinse the parts thoroughly with distilled water.

5. Troubleshooting the WACP family of devices

This chapter describes the troubleshooting of the Welch Allyn CardioPerfect family of devices:

ECG Recorder	CardioPerfect Pro Cardiograph
	CardioPerfect MD / Portable Cardiograph
	Recollect MiniHolter
Ambulatory Blood Pressure Device	ABPM 6100
	Mobil-O-Graph
Spirometry	SpiroPerfect VCT 400
	Welch Allyn SpiroPerfect

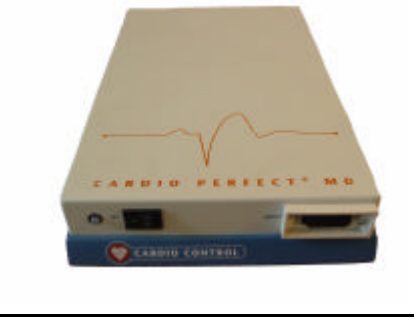
⚠	**Caution**	It is not allowed to open the Welch Allyn CardioPerfect family of devices for troubleshooting / repair.
		Opening the device will void the warranty.
		Replace accessories only with parts supplied or approved by Welch Allyn. The use of any other accessories can lead to inferior device performance and will void the warranty.

5.1 Problem-Solving suggestions CardioPerfect Pro Cardiograph

System Failure Problems		
Condition	**Causes**	**Actions**
Recorder don't switch on when starting an ECG recording	• ProLink interface cable not connected to USB port of the computer	• Verify the connection to the computer
	• ProLink interface cable not connected to PC interface connector of the CardioPerfect Pro Cardiograph	• Verify the connection to the CardioPerfect Pro Cardiograph
	• Wrong device selected in the Welch Allyn CardioPerfect software	• Check the recorder settings in the Welch Allyn CardioPerfect software see the WACP resting ECG manual
	• ProLink interface cable is defective	• Replace ProLink interface cable
ECG recorder LED is not on during ECG recording	• Defective LED	• Send the unit in for repair
ECG recorder LED is red when powered by USB and without battery pack	• Defective PRO recorder	• Send the unit in for repair
ECG recorder LED is red when powered by a battery pack	• Battery pack not charged	• Charge the battery pack and retry
	• Battery pack defective	• Replace the battery pack and retry
	• Defective PRO recorder	• Send the unit in for repair
On/Off switch doesn't function when	• Intended use	• None

powered by USB and without battery pack		
On/Off switch doesn't function when powered by a battery pack	• Defective PRO recorder	• Send the unit in for repair

5.2 Problem-Solving suggestions CardioPerfect MD / Portable Cardiograph



System Failure Problems		
Condition	**Causes**	**Actions**
LED is not on and optical fiber doesn't gives an output (red light) after switching the recorder on	• Empty battery	• Replace battery type 6LR61
	• Battery cable is broken	• Replace battery cable part number SE-BAT-CON
LED is not on but the optical output gives a red light	• LED defective	• Send the unit in for repair
LED is on (green light) but the optical output doesn't gives a red light	• Defective recorder	• Send the unit in for repair
LED is on (red light)	• Battery almost empty	• Replace battery type 6LR61
	• Defective recorder	• Send the unit in for repair
LED is on (green light) and the optical output gives a red light but not possible to record an ECG	• Optical fiber defective	• Replace optical fiber part number o SE-FIBER-05 (5 meter) o SE-FIBER-10 (10 meter)
	• UniLink or CPCOM interface card defective	• Replace interface
	• Recorder defective	• Send the unit in for repair

5.3 Problem-Solving suggestions Recollect MiniHolter

System Failure Problems		
Condition	**Causes**	**Actions**
Display is not working correctly	• Defective display	• Send the unit in for repair
Time settings resets when the batteries are removed	• Internal memory battery empty	• Send the unit in for repair
Patient symbol is flashing	• Patient electrodes hookup not correct	• Check the hookup of the electrodes
	• Patient cable	• Patient cable not fitted correctly in the Recollect MiniHolter
		• Defective patient cable try to replace it
Battery symbol is flashing	• Batteries	• Replace Batteries
Flash card symbol is flashing	• Flash card formatted under Windows XP	• Format the card using Windows XP
	• Flash card not c onfigured correctly	• Configure the card using the Recollect card format tool see the WACP MiniHolter manual
	• Flash card doesn't contain a patient or protocol	• Prepare the flash card see the WACP MiniHolter manual
	• Flash card defective	• Replace the flash card
Green LED is not burning during recording	• LED defect	• Send the unit in for repair
No sound when starting a recording on the MiniHolter	• Sound is set to L0 on the MiniHolter	• Verify the setting on the MiniHolter see the WACP MiniHolter manual
	• Defective MiniHolter	• Send the unit in for repair

5.4 Problem-Solving suggestions ABPM 6100

System Failure Problems		
Condition	**Causes**	**Actions**
No communication between the ABPM6100 and the computer	• Interface cable	• Check if the interface cable is correctly connected
		• Interface cable defective try to replace it
	• Batteries	• Replace batteries
	• Ambulatory Blood Pressure setting	• Verify if the correct serial port is selected in the WACPWS software, see the WACP ABP manual.
	• Serial port	• Serial port is blocked by another application, use the comlist tool provided on the WACPWS CDROM in the folder tools to check this.
		• Verify the correct working of the serial port
Cycle starts but cuff will not fully inflate	• Cuff	• Ensure a connection with the ABPM 6100 is secure
		• Check bladder for leak
	• Batteries	• Replace batteries
Blood Pressure readings are not	• Blood pressure protocol	• Verify if the setting "show

displayed during Regular Runs.		measurements on device" is on, see the WACP ABP manual.
Patient activation button does not initiate readings while in the Regular Run mode.	• Ambulatory Blood Pressure setting	• Verify if the "Enable start button" is checked in the ABP settings of the CPWS software, see the WACP ABP manual.

The ABPM 6100 monitor displays error codes whenever an error situation is encountered. Error codes will display on the unit's LCD. Error codes that apply to a specific reading will also display in the ABP Workstation Software when the data is read from the unit. The following table explains error codes generated by the ABPM 6100 monitor along with possible solutions for each error code.

ABPM6100 Error codes

Error code	Causes	Actions
1	Weak or no Oscillometric signal	Check cuff position and cuff tightness
2	Artifact/Erratic Oscillometric Signal	Instruct patient to remain still during reading. Try reading again.
3	Exceeded retry count (4 inflate attempts)	Instruct patient to remain still during reading. Try reading again.
4	Exceeded measurement time limit (120 seconds)	Check air hose connections and make certain cuff is tight enough.
85	Reading aborted (blocked valves or pneumatics)	Check air hose connections and make certain air tubing is not crimped.
86	Reading aborted (manual abort)	Push Start/Stop button to restart reading
87	Reading aborted (inflate time-out or air leak)	Check air hose and cuff
88	Reading aborted (safety time-out)	Push Start/Stop button to restart reading. If problem persists, return for servicing.*
89	Reading aborted (cuff overpressure)	Check air hose for blockage or kinking
90	Service Required (power supply out-of-range or other hardware problem)	Replace batteries. If problem persists, return for servicing.*
91	Service Required (safety override fitted or auto zero out-of-range)	Push Start/Stop button to retry reading. If problem persists, return for servicing.*
97	Service Required Transducer out-of-range	Return for servicing*
98	Service Required (A/D out-of-range)	Return for servicing*
99	Service Required (EEPROM calibration data CRC failure)	Unit needs to be recalibrated. Return for servicing.*

The codes mentioned above, are the codes as shown on the device display. Please refer to the WACPW ABP Software manual for the codes as used by the software.

5.5 Problem-Solving suggestions Mobil-O-Graph

System Failure Problems		
Condition	**Causes**	**Actions**
No communication between the ABPM6100 and the computer	• No CO on display Mobil-O-Graph	• Connect first the interface cable to the Mobil-O-Graph and then switch it on
	• USB to Serial converter	• Verify if the correct interface cable is used, part number ABP-Cable-2
	• Interface cable	• Check if the interface cable is correctly connected
		• Interface cable defective try to replace it
	• Batteries	• Replace batteries
	• Ambulatory Blood Pressure setting	• Verify if the correct serial port is selected in the WACPWS software, see the WACP ABP manual.
	•	• Try the “Use safe initialization” see the WACP ABP manual.
	• Serial port	• Serial port is blocked by another application, use the comlist tool provided on the WACPWS CDROM in the folder tools to check this.
		• Verify the correct working of the serial port
Cycle starts but cuff will not fully inflate	• Cuff	• Ensure a connection with the Mobil-O-Graph is secure
		• Check bladder for leak
	• Batteries	• Replace batteries
Blood Pressure readings are not displayed during Regular Runs.	• Blood pressure protocol	• Verify if the setting “show measurements on device” is on, see the WACP ABP manual.
Time settings resets when the batteries are removed	• The internal battery (rechargeable) is flat	• Leave the Mobil-O-Graph to stand switched on, for a period of at least 24 hours if that doesn’t solve the problem the internal battery needs to be replaced send the unit in for repair
No measurements were carried out during the night phase	• The batteries were drained prematurely.	• The rechargeable batteries may be defective try replacing them
	• The patient switched off the Mobil-O-Graph.	• Alert the patient to the urgency of obtaining a complete 24-hour recording
No automatic measurements are carried out	• The first manual measurement was unsuccessful or not performed	• Carry out a new manual measurement.
The measurement interval is not as you expected	• An incorrect protocol was set	• Verify the protocol, see the WACP ABP manual

The Mobil-O-Graph displays error codes whenever an error situation is encountered. Error codes will

display on the unit's LCD. Error codes that apply to a specific reading will also display in the ABP Workstation Software when the data is read from the unit. The following table explains error codes generated by the ABPM 6100 monitor along with possible solutions for each error code.

ABP Perfect Error codes

Error code	Causes	Actions
E.001	Battery voltage to low	Check battery voltage • NiMH batteries: U > 2,75 V • Alkaline batteries: U > 3,10 V
	The patient has severe arrhythmias	N/A
	Inadequate pulse beats detected	Refit the cuff
E.002	The arm was moved during the measurement	Instruct the patient to keep the arm still during measurement
	Cuff not correctly fitted on the arm	Check the fit of the cuff and the unit
E.003	Battery voltage to low	See E.001
	Blood pressure outside measurement range	N/A
E.004 + 5 beeps	Data transfer cable not correctly inserted in the recorder	Plug the cable into the recorder correctly
	Pins in plug of interface cable have suffered mechanical data	Check the plug to see whether pins inside are damaged
	Measurement value not correctly transferred	Start the transfer again
E.005 bAT	Battery voltage to low	See E.001
	Batteries defective	The battery voltage is correct as far as E.001 is concerned, but during cuff inflation, bAT is shown on display. Replace the batteries
	Battery cover not correctly closed	Push the battery cover on the battery compartment, until it engages.
	Battery contacts are corroded	Clean the battery contact with a cotton cloth and some alcohol
E.006 + Continuous alarm	Air tube blocked	Check the cuff for a blockage or kink in the tube. If there is a kink in the cuff tube, release the tube. Otherwise send the unit in for repair
	Battery voltage to low	See E.001
	Blood pressure cuff is not correctly connected	Check the cuff connection
	Leak in cuff or connecting tube	Perform the seal test
E.007	The recorder memory is full (maximum 300 measurements and Events may be stored)	Transfer and delete the data of the Mobil-O-Graph into the WACPWS software
E.009 + Continuous alarm	Serious fault due to pressure build up outside the measurement process	Device has to be send in for repair

The codes mentioned above, are the codes as shown on the device display. Please refer to the WACPW ABP Software manual for the codes as used by the software.

5.6 Problem-Solving suggestions Welch Allyn SpiroPerfect

System Failure Problems		
Condition	**Causes**	**Actions**
The Device (sensor) is not responding	• Computer lost connection to the sensor	• Disconnect and reconnect the sensor.
	• Software setting	• Check if the port settings in the WACP settings menu correspond with the used COM-port
Measured values are incorrect	• Wrong linearization file	• Verify LOT number and perform a verification test.
	• Hardware problem	• Check the flow transducer for potential obstruction.
	• Out of calibration	• Do a volume calibration to check the gain-factor and to recalibrate the device if necessary.
Values are too high (intermittent)	• Procedure error	• Retest with fingers positioned properly around the flow transducer. Do not block the end of the flow transducer with your fingers or hand.
Flow data is out of range (measured flow has exceeded the allowable limits)	• Out of calibration	• Recalibrate with a 3-liter syringe
The program does not predict values or the values appear incorrect	• Software setting	• Check in the settings menu to see if the correct author is selected.
	• Wrong information entered	• Verify that the date of birth, gender, race and the height of the patient information are entered in the patient card; these are needed for the calculation of the predicted values.
Unable to calibrate	• Wrong linearization file	• Verify LOT number and perform a verification test.
	• Hardware problem	• Check the connection between flow transducer and sensor.
		• Replace the flow transducer.
		• Check that the connection between the syringe and the flow transducer is tight and without leaks.
Patient test values differ from values expected by physician	• Wrong linearization file	• Verify LOT number and perform a verification test.
	• Wrong Ambient setting	• Verify the barometric pressure.
	• Out of calibration	• Recalibrate with a 3-liter syringe
	• Hardware problem	• Replace the flow transducer.
		• Eliminate any leaks in the pressure tubing.
		• Replace the sensor if damaged.
	• Wrong information entered	• Verify the patient data. The norm selection is dependent upon accurate input of patient data in the SpiroPerfect database.

5.7 Problem-Solving suggestions SpiroPerfect VCT 400

System Failure Problems		
Condition	**Causes**	**Actions**
The Device (sensor) is not responding	• Hardware power problem, green LED is not on (computer is on)	• Check if the flow sensor is switched on (switch located on the bottom of the device).
		• PS2 cable is not connected to the PS2 port of the computer
		• Send the unit in for repair
	• Hardware connection problem	• Check if the device is connected to a COM port
	• Software setting	• Check if the port settings in the WACP settings menu correspond with the used COM-port
Measured values are incorrect	• Hardware problem	• Check the sensor. Take it out of the device and move it freely in the room so that air streams through it. The fan should rotate when you move it and stop quite abrupt when the movement is stopped (provided there is no draft in the room. If the vane does not rotate freely, the turbine probably needs to be replaced.
	• Out of calibration	• Do a volume calibration to check the gain-factor and to recalibrate the device if necessary.
Values are too high (intermittent)	• Procedure error	• Retest with fingers positioned properly around the flow transducer. Do not block the end of the flow transducer with your fingers or hand.
Flow data is out of range (measured flow has exceeded the allowable limits)	• Out of calibration	• Recalibrate with a 3-liter syringe
The program does not predict values or the values appear incorrect	• Software setting	• Check in the settings menu to see if the correct author is selected.
	• Wrong information entered	• Verify that the date of birth, gender, race and the height of the patient information are entered in the patient card; these are needed for the calculation of the predicted values.
Unable to calibrate	• Hardware problem	• Check that the connection between the syringe and the flow transducer is tight and without leaks
		• Replace the sensor.
Patient test values differ from values expected by physician	• Wrong Ambient setting	• Verify the barometric pressure.
	• Out of calibration	• Recalibrate with a 3-liter syringe
	• Hardware problem	•
	• Wrong information entered	• Verify the patient data. The norm selection is dependent upon accurate input of patient data in the SpiroPerfect database.

6. Troubleshooting WACP Workstation

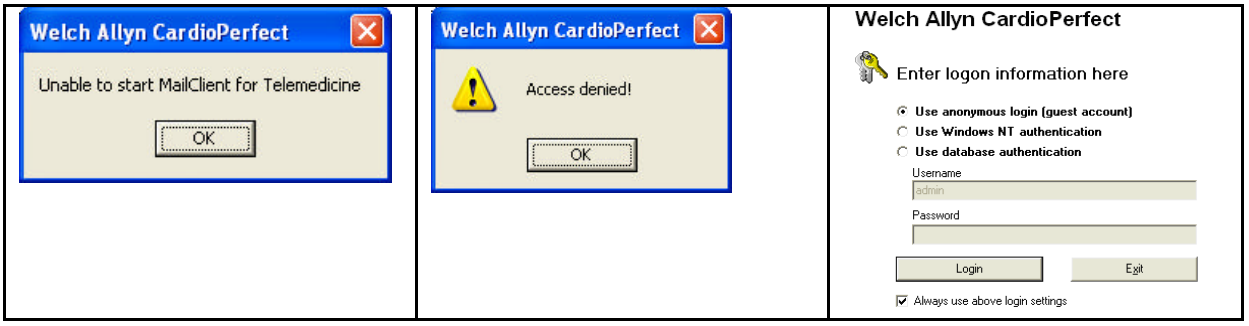
6.1 Problem: Access denied after logon

The Problem Access denied can be caused by:

- Not running SQL database.
- Corrupted database.
- User deactivated in the Administrator Tool.
- Wrong login name or password.
- Firewall.

6.1.1. Not running MSSQL database

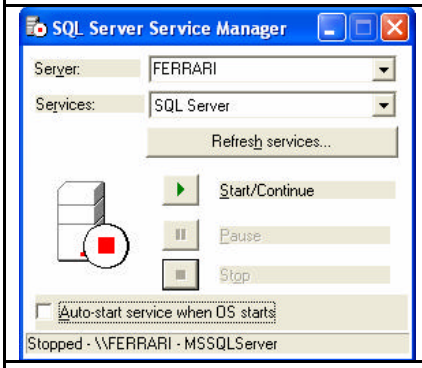
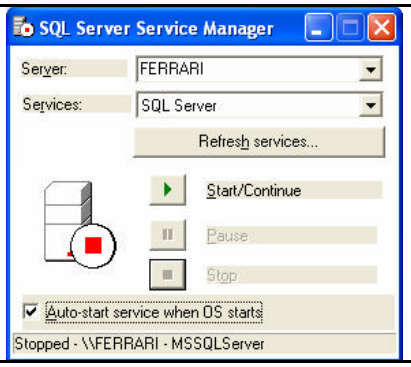
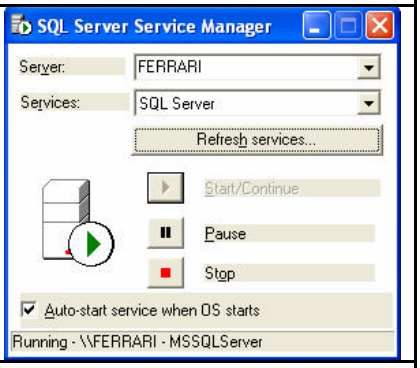
Not running of the database causes one or all of the following error messages on the screen:



The MSSQL server does not run can be caused by:

- Computer has been restarted and Auto-Start service was not activated.
- If MSDE 7 is used, the computer network name has been changed.
- Corrupted MSSQL installation.

Verify that the MSSQL Server is running by starting the MSSQL service manager:

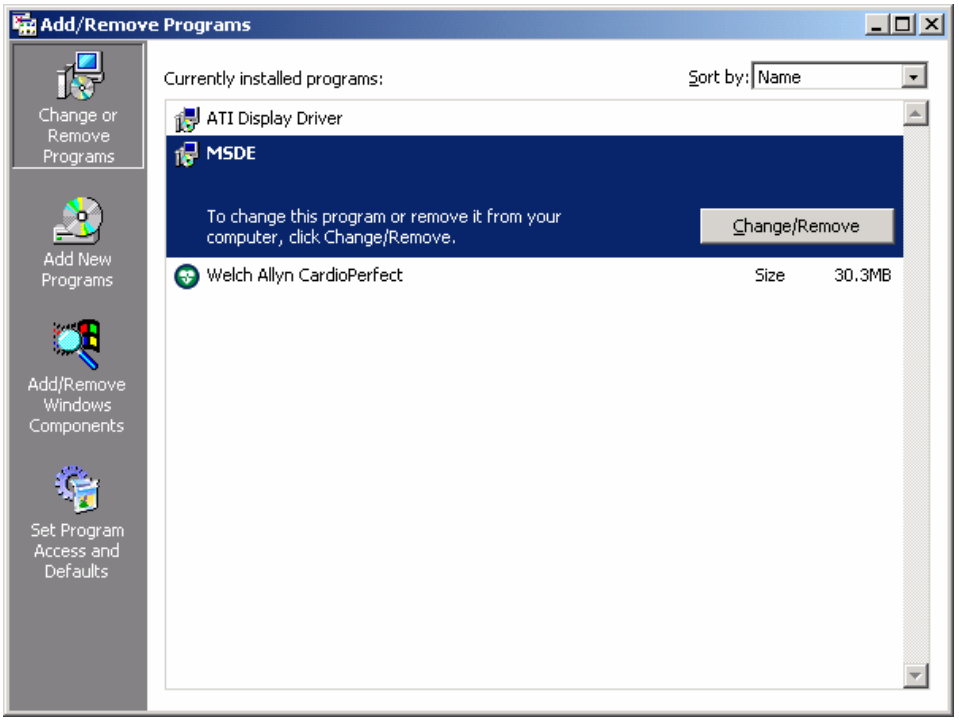
Scenario I	Scenario II	Scenario III
MSSQL server is not running and Auto-start Service was not activated.	MSSQL server is not running.	MSSQL server is running.
		
Activate the Auto-start service Try to start the MSSQL database.	Try to start the MSSQL database.	Go to Next Paragraph.
If the MSSQL database doesn't start it needs to be reinstalled use the following procedure.	If the MSSQL database doesn't start it needs to be reinstalled use the following procedure.	

Reinstalling the MSSQL database

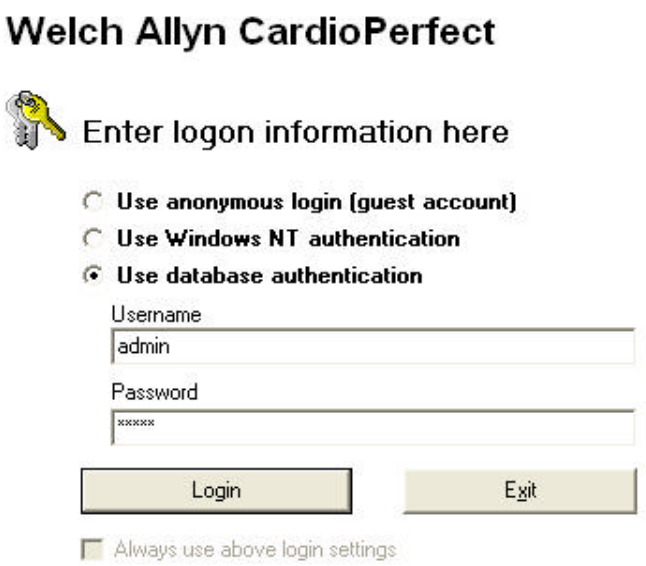
⚠	**WARNING**	**Deleting the MSSQL database will delete all data and is irreversible.**

- Before removing the MSSQL database we advise to copy the data folder and the most recent backup to a save place on the hard disk.
  - The standard database created by the Welch Allyn CardioPerfect software is called CCDB and this database consist of the following files:
    CCDB_DAT.MDF
    CCDB_LOG.LDF
    CCDBAUDIT_DAT.MDF (Only CPWS software 1.5.0 or higher)
    CCDBAUDIT_LOG.LDF (Only CPWS software 1.5.0 or higher)
  - If there are additional databases created make sure that you copy them to a save place on the hard disk.

- Remove the MSSQL database by using the Add/Remove programs option in the control panel.



- Restart the computer after removing the MSSQL database.
- Reinstall the database using the Welch Allyn CardioPerfect CDROM for further instructions see the Installation manual (during the reinstalling of the MSSQL server an empty ccdb database will be created).
- Try to logon to the Welch Allyn CardioPerfect software. using database authentication.
  Username *admin*
  Password *admin*



- If this works you can consider restoring the old data.

Restoring the old data

You can try to restore the old data using the following options:

- Restoring a backup.
- Attaching a database (only possible with version 1.5.0 or full MSSQL license).
- Copying the old data.

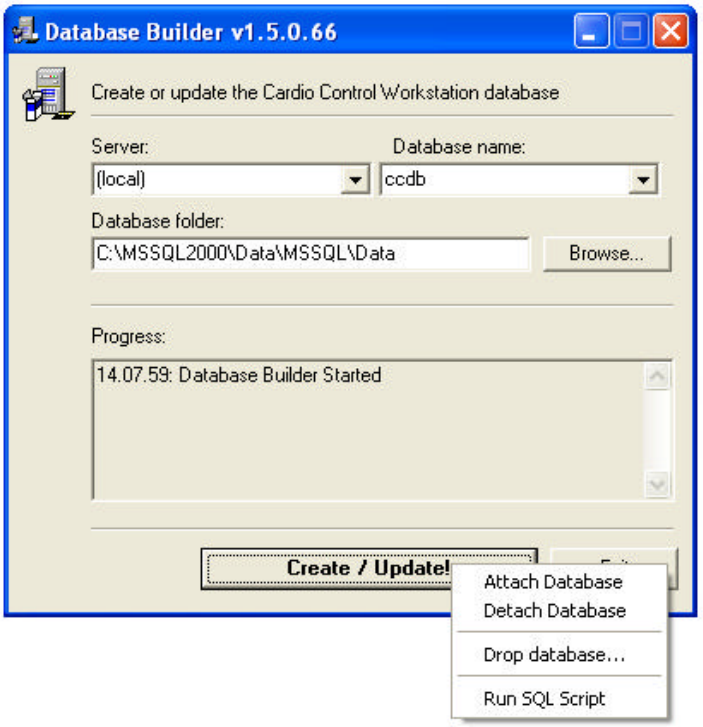
If the restore of the database fails contact the nearest Welch Allyn Technical Support Center.

a) Restoring a backup

- If the MSSQL server is reinstalled you first need to create an empty backup before you can restore the backup.
- Replace this backup file by the old backup file.
- Restore the database.

b) Attaching a database

- You can attach a database with the use of the MSSQL Enterprise manager; this tool is only available on a full MSSQL server.
- With the DBBuilder tool* provided on the Welch Allyn CardioPerfect CDROM (SQL folder) you can attach the database using the following procedure:
- This option is only available on the DBBuilder tool from version 1.5.0 and higher.
- Start the DBBuilder tool and right click on the **Create / Update** button.



- Select the option **Drop database** and follow the instructions on the screen.

⚠	**WARNING**	**Deleting the MSSQL database will delete all data and is irreversible.**

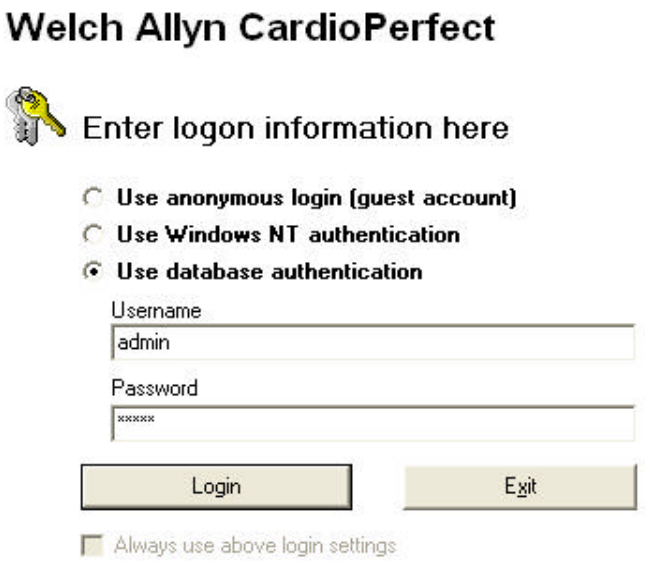
- right click on the **Create / Update** button.
- Select the Attach database option.
- Select the folder and the database you want to attach.

c) Copying the old data

You can try to restore the data by overwriting the newly created database files with the old database files. This is not a recommended way of restoring the data and Welch Allyn can not guarantee that this will work.

⚠	**WARNING**	**This is not a recommended way of restoring the data and Welch Allyn can not guarantee that this will work.**

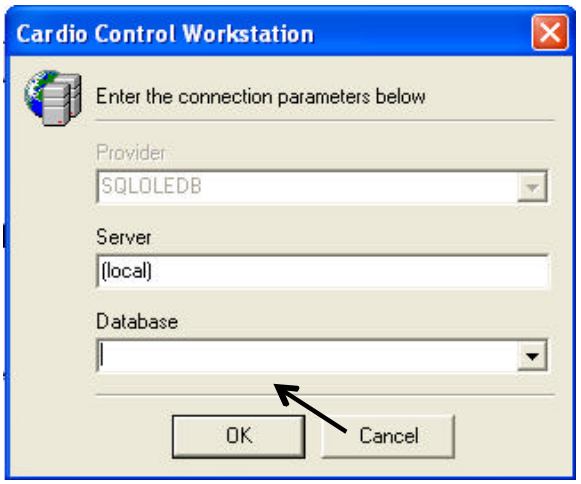
- Stop the MSSQL service manager.
- Overwrite the newly created database files with the old database files.
- Start the MSSQL service manager.
- Try to logon to the Welch Allyn CardioPerfect software using database authentication.
  Username *admin*
  Password *admin*



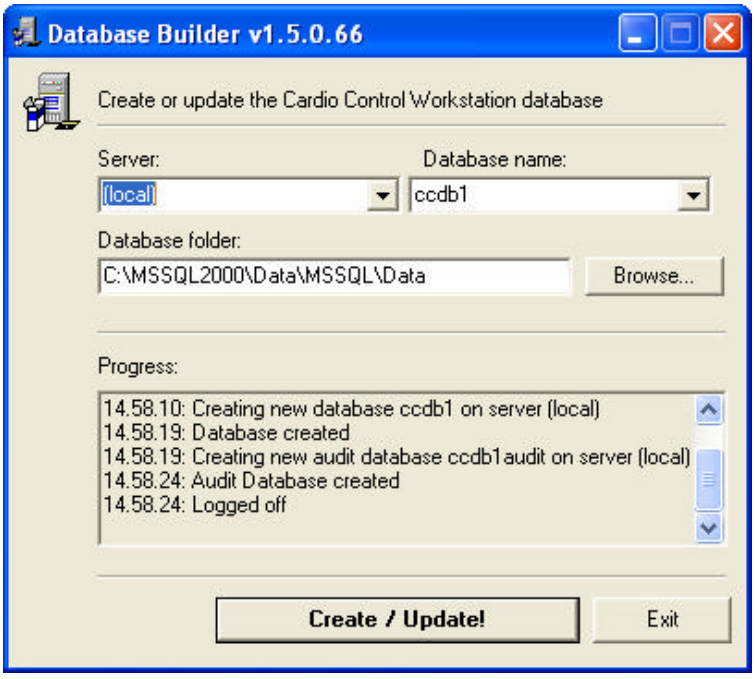
6.1.2. Corrupted database

To determine if the database is corrupted you need to use the following procedure:

- Start the **Connection Setup** in the Welch Allyn group.
- Try to select the database by clicking on the dropdown button.



- If you are able to select the database (for example ccdb) this means that the database is not corrupted go to chapter 6.1.4 for further instructions.
- Create a new database using the DBBuilder tool provided on the Welch Allyn CardioPerfect CDROM (SQL folder).
- Replace the CCDB name with CCDB1 (for example) and click on the **Create / Update** button.



- Observe the creation of the database. In cases of errors proceed to paragraph 6.1.5.
- Try to select the newly created database using the **Connection Setup.**
- If you are able to select this newly created database you can conclude that the original database is corrupted.

Restoring the corrupted database

If there is a recent backup available you can try restoring this backup. If this restore fails you can try the following procedure.

- Remove the database files manually.
  - CCDB_DAT.MDF
  - CCDB_LOG.LDF
  - CCDBAUDIT_DAT.MDF (Only CPWS software 1.5.0 or higher)
  - CCDBAUDIT_LOG.LDF (Only CPWS software 1.5.0 or higher)
- Create a new database ccdb using the DBBuilder tool provided on the Welch Allyn CardioPerfect CDROM (SQL folder).
- Try to restore the backup.

6.1.3. User deactivated in the Administrator tool

Try to logon to the Welch Allyn CardioPerfect software using database authentication.

- Username* *admin*
- Password* *admin*

*If you have changed the username or password use the modified logon information.

If the logon succeeds you need to verify the user settings in the administrator tool.

6.1.4. Wrong login name or Password

Verify the user settings in the administrator tool.

6.1.5. Firewall

In some cases the firewall can block the connection between the client software and the MSSQL database. To eliminate this possibility disable the firewall or open the port 1433 (SQL_server uses this TCP/IP port) and try to logon to the Welch Allyn CardioPerfect software using database authentication.

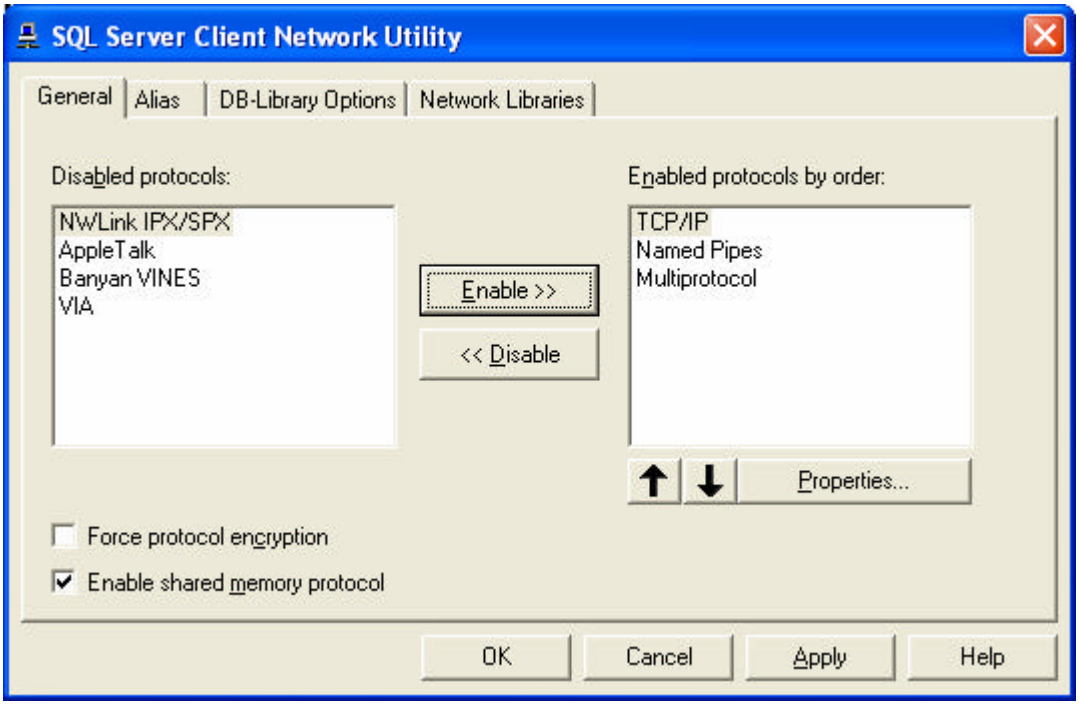
- Username* *admin*
- Password* *admin*

*If you have changed the username or password use the modified logon information.

When you are able to logon to the Welch Allyn CardioPerfect Workstation Software you can try to resolve the problem with the firewall by:

- Configuring the Firewall that it accepts the connection to the MSSQL server, for further instructions see the instruction manual of the Firewall software.

- Selecting another protocol in the CLICONFG tool (C:\windows\system32\cliconfg.exe)
  - Add the Multiprotocol, TCP/IP and Named Pipes.



- After applying the changes try to logon to the Welch Allyn CardioPerfect Workstation Software.
- If the logon fails contact the nearest Welch Allyn Technical Support Center.

6.2 Problem: Invalid release code

The following error code can be caused by:

- Mistyping of the serial number or release code, please verify.
  - This numbers.
  - The letter O is not a valid input in the release code. Replace existing letters O with the number 0.
- Release code doesn't match the software version. Contact the nearest Welch Allyn Technical Support Center for verification of the numbers.

6.3 Problem: Can not use all the functions in the software

The user can not use all the functions in the Welch Allyn CardioPerfect Workstation software. This can be caused by the following:

- User has limited rights in the WACPWS software.
- User has limited rights on the operating system of the computer.
- Release code invalid.

6.4 Problem: Limited rights in the WACPWS software

Use the following procedure to verify this:

- Logon to the Welch Allyn CardioPerfect software. using database authentication.
  - Username* *admin*
  - Password* *admin*

  *If you have changed the username or password use the modified logon information.
- Check the user settings in the administrator tool.

6.5 Problem: Limited rights on the operating system

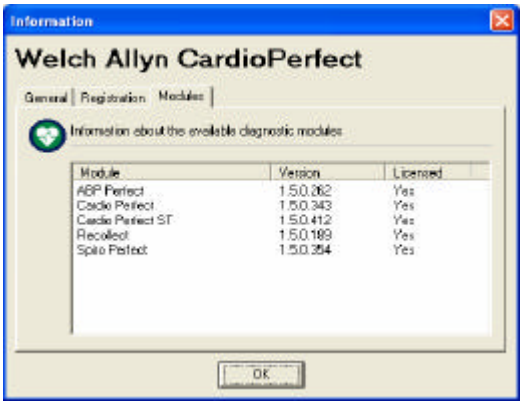
Use the following procedure to verify this:

- Logon on the computer as a local administrator.
- If the missing functions are still not accessible go to next chapter.
- The restrictions are caused by the local security policy.

6.6 Problem: Release code invalid

The release code activates the different modules in the WACPWS software. To verify which modules are activated use the following procedure:

- Start the WACPWS software.
- Select option *help -> information -> modules*.
- Check if the expected modules are activated.



- If not all expected modules are activated contact the nearest Welch Allyn Technical Support Center with a proof of purchase.

7. Problem-Solving suggestions Resting ECG module

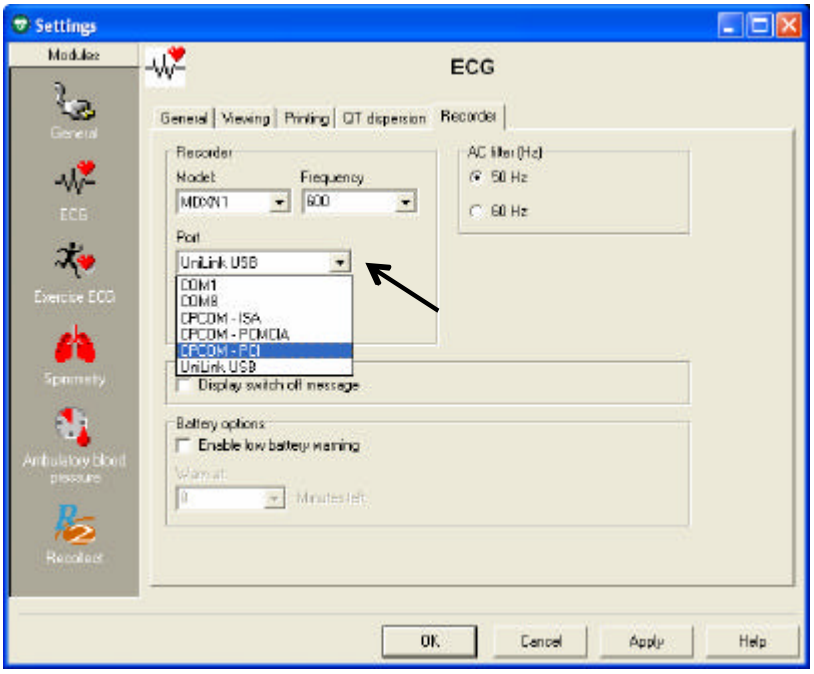
This chapter describes the most common problem suggestions of the Resting ECG module.

7.1 Problem: Invalid WDM handle Error message

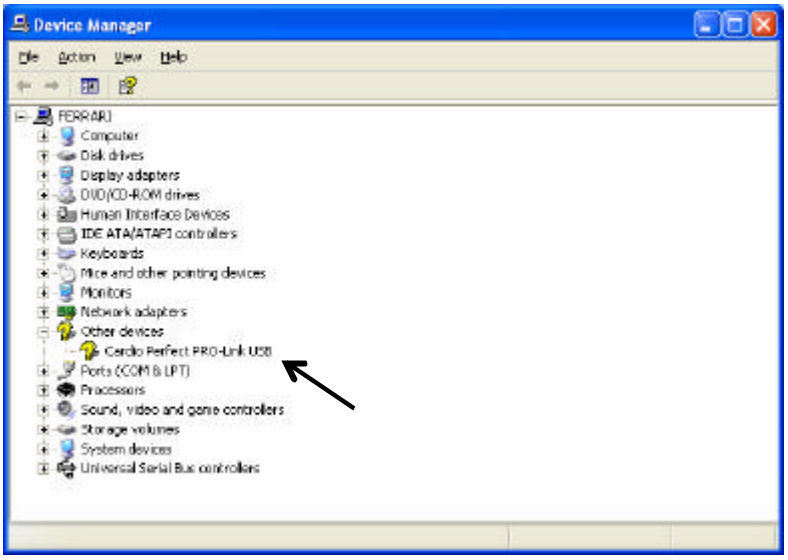
The invalid WDM Handle error is related to the driver of the UniLink USB or ProLink interface cable.

Use the following procedure to resolve the problem:

- Determine first if the connection between the recorder and the computer is a USB interface cable. If not change the port setting in the WACPWS software to the correct interface. For further instructions see the WACP Resting ECG manual.



- Verify if the USB interface cable is connected to the USB port of the computer.
- If the system worked before without any problem reboot the computer and verify if the problem is resolved.
- Check the device manager to see if the ProLink or UniLink USB is correctly installed. If you don't see the device on the Other Devices tab reinstall the driver. For further instructions see the WACP Resting ECG manual.



- If the above suggestions don't resolve the problems contact the nearest Welch Allyn Technical Support for further assistance.

7.2 Problem: Fatal Port Error during recording

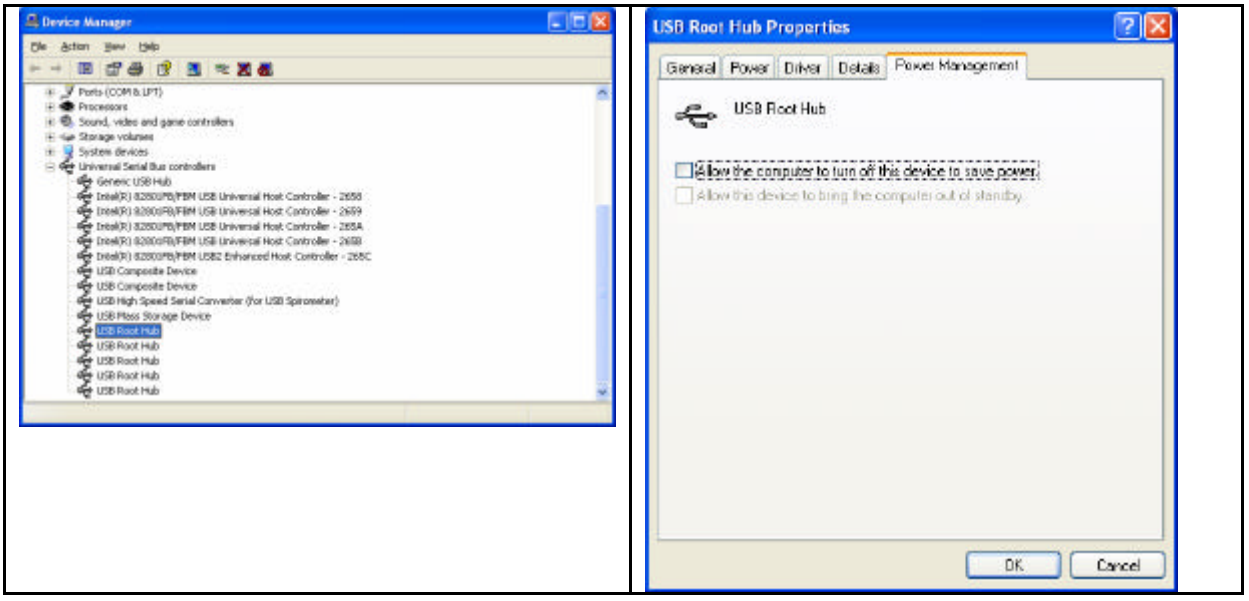
Fatal port Errors are caused by data loss. This data loss can be caused by:

- Power management on the computer.
- Other applications/hardware which are interfering with the communication.
- Defective hardware.

7.2.1. Power management

To avoid data losses switch off the power savings as much as possible:

- Power savings in the BIOS of the computer for further instructions please refer to the manual of the computer.
- Windows Power management (Control panel0 for further instructions please refer to the manual of the computer.
- Switch off the power management for each USB port (only applicable for Windows XP).



7.2.2. Applications/Hardware interfering

Data loss can occur by applications or hardware which is interfering with the communication on the USB port for example:

- Wireless network when not connected.
- Bluetooth manager.
- Infrared port.
- Antivirus program.
- Try to switch off the possible interfering products to see if this will resolve the problem. If the above suggestions don't resolve the problems contact the nearest Welch Allyn Technical Support for further assistance.

7.2.3. Defective hardware

Data loss can occur by defective hardware try to replace the following components:

- ProLink or optical fiber interface cable.
- ECG recorder.

7.3 Problem: Framing Errors during recording

Framing Errors on the screen can occur by:

- Wrong recorder settings in the WACPWS software. For further instructions please refer to the WACP Resting ECG manual.
- Defective hardware try to replace the following components:
  - ProLink or optical fiber interface cable.
  - ECG recorder.

7.4 Problem: Lead Quality problems

The following table describes different lead quality problems and possible actions to try to resolve this. If you can not resolve the problem please contact the nearest Welch Allyn Technical support for further assistance.

Condition	Causes	Actions
Bad signal quality on screen OR Indication on screen: Bad signal quality and One or more leads prints as a square wave	• Electrode contact may be poor • A lead may be loose	• Reattach the lead • Replace the electrode • Verify that the electrode area has been properly prepared: shaved, cleaned with alcohol or acetone, allowed drying.
Wandering baseline (an upward and downward fluctuation of the waveforms	• Electrodes that are dirty, corroded, loose, or positioned on a bony area. • Insufficient or dried electrode gel. • Oily skin or body lotions • Rising and falling of chest during rapid or apprehensive breathing.	• Clean skin with alcohol or acetone • Reposition or replace electrodes • Help patient relax • If wandering baseline persists, turn the baseline filter on. For further instructions see the WACP resting ECG manual.

Muscle tremor interference (random irregular voltage superimposed on the waveforms). May resemble or coincide with AC interference	• Patient is uncomfortable, tense, nervous • Patient is cold and shivering • Exam bed is too narrow or short to comfortably support arms and legs. • Arm or leg electrode straps are too tight.	• Help patient get comfortable • Check all electrode contacts • If interference persists, turn the muscle filter on. For further instructions see the WACP resting ECG manual. • If interference still persists, the problem is probably electrical in nature. See the following suggestions for reducing AC interference
AC interference (even-peaked, regular voltage superimposed on the waveforms). May resemble or coincide with muscle tremor interference	• Electrodes that are dirty, corroded, loose, or positioned on a bony area. • Insufficient or dried electrode gel. • Patient or technician touching an electrode during recording. • Patient touching any metal parts of an exam table or bed. • Broken lead wire, patient cable or power cord. • Electrical devices in the immediate area, lighting, concealed wiring in walls or floors. • Improperly grounded electrical outlet. • Incorrect AC filter frequency setting or AC filter is turned off.	• Check all electrode contacts and lead wires. • Verify that the patient is not touching any metal. • Verify that the AC power cable is not touching the patient lead cable. • Verify that the proper AC filter is selected. . For further instructions see the WACP resting ECG manual. • If possible unplug electrical devices in the immediate area. • If interference still persists, the noise may be caused by other equipment in the room or by poorly grounded power lines. Try moving to another room.

7.5 Problem: Interference on printout but not during recording

After recording the ECG on the computer the signal quality is less than during the recording on the screen. Activate for viewing/printing the ECG the same filter settings as during the recording of the ECG, for further instructions see the WACP resting ECG manual.

7.6 Problem: No Automatic computer interpretation on ECG

This can be caused by the following:

- Software was not able to make an average complex because of:
  - Bad ECG signal.
  - Complexes differ too much.
  - Complexes are outside the set limits.
- Pediatric lead set used (V3R,V1,V2,V4,V6,and V7) without the Pediatric MEANS option available.
- MEANS option not available, contact the nearest Welch Allyn Technical Support Center with a proof of purchase.

8. Problem-Solving suggestions Exercise ECG module

This chapter describes the most common problem suggestions of the Exercise ECG module. For the following problems refer to the appropriate chapters in the Exercise ECG manual.

Problem	Chapter
Invalid WDM Handle	7.1
Fatal Port Error during recording	7.2
Framing errors during recording	7.3

8.1 Problem: Lead Quality problems

The following table describes different lead quality problems and possible actions to try to resolve this. If you can not resolve the problem please contact the nearest Welch Allyn Technical support for further assistance.

Condition	Causes	Actions
Bad signal quality on screen OR Indication on screen: Bad signal quality and One or more leads prints as a square wave	• Electrode contact may be poor • A lead may be loose	• Reattach the lead • Replace the electrode • Verify that the electrode area has been properly prepared: shaved, cleaned with alcohol or acetone, allowed drying.
Wandering baseline (an upward and downward fluctuation of the waveforms	• Electrodes that are dirty, corroded, loose, or positioned on a bony area or muscle. • Insufficient or dried electrode gel. • Oily skin or body lotions • Rising and falling of chest during rapid or apprehensive breathing.	• Clean skin with alcohol or acetone • Reposition or replace electrodes • If wandering baseline persists, turn the baseline filter on. For further instructions see the WACP Stress ECG manual
Muscle tremor interference (random irregular voltage superimposed on the waveforms). May resemble or coincide with AC interference	• Patient is uncomfortable, tense, nervous • Patient is cold and shivering	• Check all electrode contacts • If interference still persists, the problem is probably electrical in nature. See the following suggestions for reducing AC interference
AC interference (even-peaked, regular voltage superimposed on the waveforms). May resemble or coincide with muscle tremor interference	• Electrodes that are dirty, corroded, loose, or positioned on a bony area. • Insufficient or dried electrode gel. • Patient or technician touching an electrode during recording. • Patient touching any metal parts.	• Check all electrode contacts and lead wires. • Verify that the patient is not touching any metal. • Verify that the AC power cable is not touching the patient lead cable. • Verify that the proper AC filter is selected. . For further instructions the

	• Broken lead wire, patient cable or power cord. • Electrical devices in the immediate area, lighting, concealed wiring in walls or floors • Improperly grounded electrical outlet • Incorrect AC filter frequency setting or AC filter is turned off.	WACP Stress ECG manual. • If possible unplug electrical devices in the immediate area. • If interference still persists, the noise may be caused by other equipment in the room or by poorly grounded power lines. Try moving to another room.

8.2 Problem: Exercise device is not responding

The Exercise device treadmill or ergometer doesn't respond.

- Verify the settings of the Exercise device. For further instructions see the WACP Stress ECG manual.
- Verify if the device is switched on and ready for communicating with the software, for further instructions refer to the exercise device manual.
- In case of treadmill verify the emergency button is unreleased.
- Verify the serial cable is connected correctly and not damaged.
- Verify the serial port is working correctly.
- If you can not resolve the problem please contact the nearest Welch Allyn Technical support for further assistance.

9. Problem-Solving suggestions Spiro module

This chapter describes the most common problem suggestions of the Spiro module.

9.1 Problem: No samples detected

The following message appears when the device detected samples during the initialization. Retry it and don't move the unit during the stabilization or breathe through the mouthpiece.

9.2 Problem: Blue screen during recording Spirometry

This problem only occurs with the SpiroPerfect VCT400 in combination with an USB to serial converter.

Note	This combination is not supported by Welch Allyn.

If there is no serial port available we advise to add a serial port using:

1. PCMCIA -> RS232 converter.
2. PCI -> RS232 converter.

10. Telemedicine

Telemedicine is an optional extension to the Welch Allyn CardioPerfect Workstation. Without the correct release code, the Telemedicine functionality will not be activated.
The Telemedicine option requires significant IT skills to install and configure.

For additional information on how to use Telemedicine please refer to the Workstation user manual.

With Telemedicine, it is possible to send and receive tests and interpretations to and from predefined contacts. This typically allows expertise sharing and second opinion consults, but might also be used for administrative purposes in situations where replication cannot be used.

Telemedicine offers a choice of two types of communication. Telemedicine messages can be sent and received either through e-mail or through direct communication using TCP/IP sockets. In both cases, the Internet or any other TCP/IP network must be available as transportation infrastructure. It is possible to use a mix of both email and direct socket connection.

Telemedicine, like Welch Allyn CardioPerfect Workstation, is built using a client / server architecture. This means Telemedicine scales from use on a single standalone computer with a modem, to a configuration of multiple client computers, a MSSQL database server and a telemedicine mail server working together in a LAN network.

10.1 Telemedicine specific Requirements

Check that the system on which you are planning to install Welch Allyn CardioPerfect Workstation with Telemedicine meets the requirements. For the minimum configuration for Welch Allyn CardioPerfect Workstation see section 3.1 System Requirements in the Installation manual.

Before installing and configuring, choose which communication type is best suited to your needs: email, direct socket or a mix of both. E-mail will probably be the best choice in most cases, as it is easily available and requires low maintenance, while direct connection might be necessary for a more time-critical use. For advice on how to create the best custom configuration, contact Welch Allyn Cardio Control B.V. or your local distributor.

When using e-mail, prior to testing the e-mail account using Telemedicine, test the account using Microsoft Outlook Express or a similar program.

Instead of using the Internet as a transportation infrastructure, you may use another WAN or LAN, as long as it is TCP/IP based and is accessible to all contacts you wish to communicate with using Telemedicine.

10.2 Installation and Configuration

This chapter explains the installation and configuration in detail.

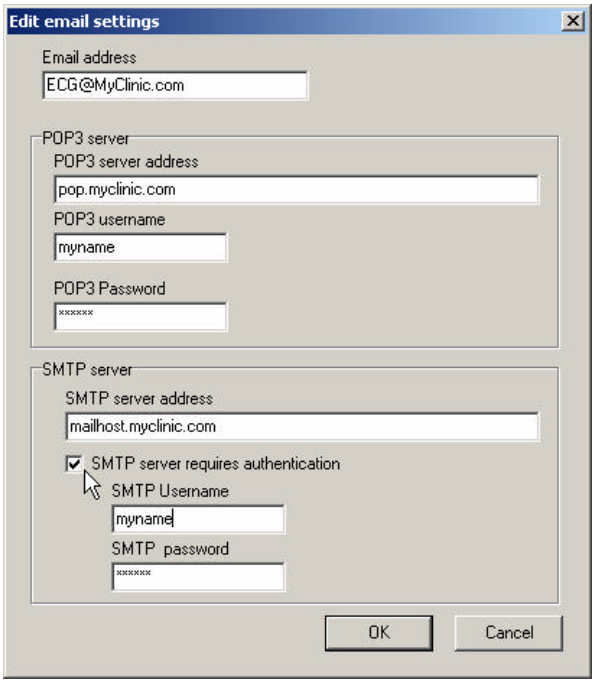
step 1. **Install Welch Allyn CardioPerfect Workstation**
If you do not have Welch Allyn CardioPerfect Workstation installed yet, do so now. See the Installation guide for guidance.
Install at least the software, database, and telemedicine server components by running the setup.

If you have a network with multiple computers running workstation clients and one computer running the database server, check the following options in the ‘Select

Components' dialog of setup.exe:
- Software on the computers running workstation.
- Database on the computer running the MSDE or MSSQL database server.
- Telemedicine server on a computer with a connection to the internet.

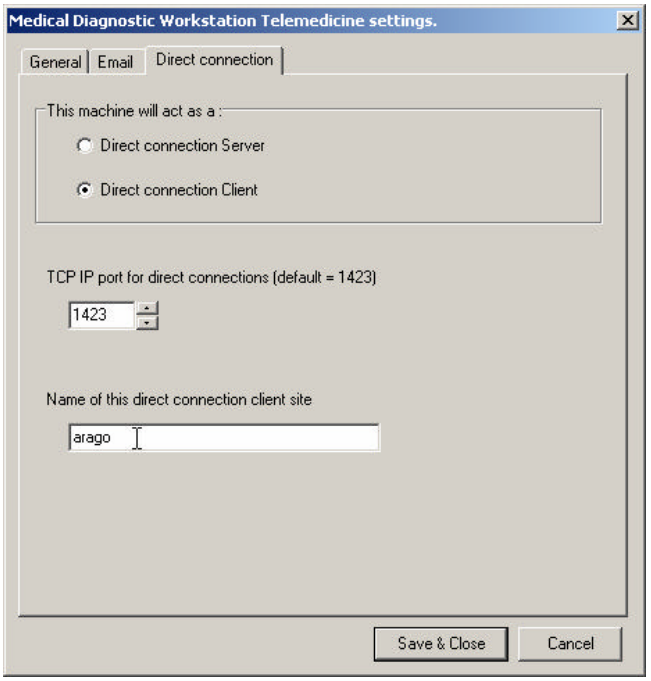
After finishing setup, continue with the next step.

step 2. **Configure the Telemedicine server**:
On the computer on which you have installed the Telemedicine server component, go to the Windows Control Panel. Double click to start the 'CC MailServer Configuration' control panel applet.
If you plan to use e-mail as communication mode, go to the e-mail tab, press Change and fill in the e-mail address, server names and login details provided by your Internet Service Provider or your network administrator.



MailServer Configuration Tool: specify email settings (example).

If you plan to use direct socket connection, fill in the direct connection tab, specifying whether this system will act as a host or a client in the direct connection communication protocol. As a client, specify a (user) name. This name is used to login at the host. This name should be identical to the contact address at the host system; it should also be unique at the host system.

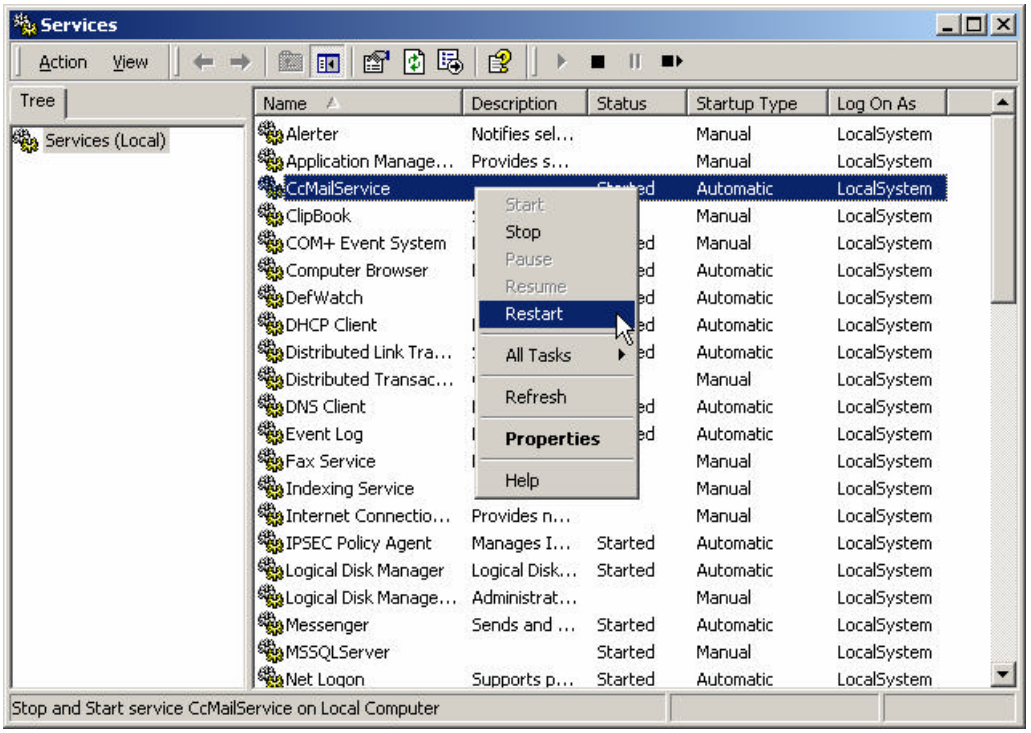


CC MailServer Configuration Tool: specify Direct Socket settings (example).

Click the Save and Close button to exit. Continue with the next step.

step 3. **(Re)Start Telemedicine Server**.

Windows 2000/XP: open the Services Microsoft Management Console. This can be found in either the Windows Control Panel or under Administrative Tools in the Programs menu. Select Cardio Control Telemedicine Service (CcMailService) and use the menu buttons or right click and use the popup menu to Restart. Continue step 6.



step 4. **Configure Workstation for Telemedicine**.

Start Workstation, and select File -> Settings… -> General from the main menu. In the Settings dialog, select the mail tab.

In the Mail server field, enter the name or IP address of the computer on which Telemedicine server is running. After changing the Mail server entry, you must exit the workstation and restart to register with the Mail server (step 7).

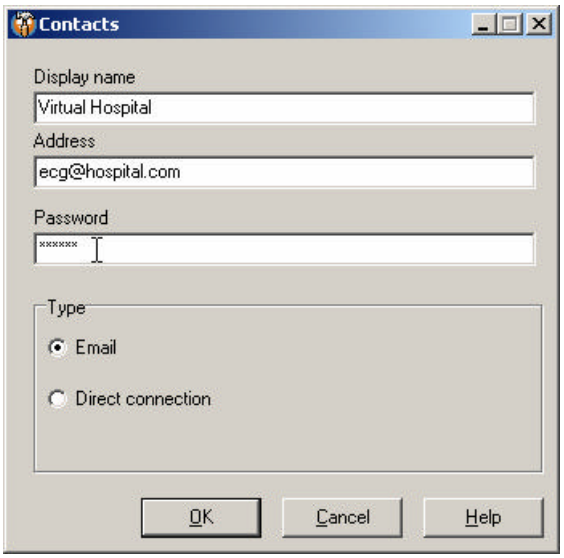
If you do not have the mail tab in the general settings, you need to change your release code to activate Telemedicine. See 'Changing the release code' in the 'Workstation Manual'.

step 5. **Restart Workstation**.

Exit Workstation and restart to apply changes and register with the Mail server.

step 6. **Add contact(s) using Administrator Tool**.

Start the Administrator Tool. Select Contacts List from the Telemedicine section. Click the Add button. Enter the contact information. The password entry must correspond between contacts on a host and on a remote system.

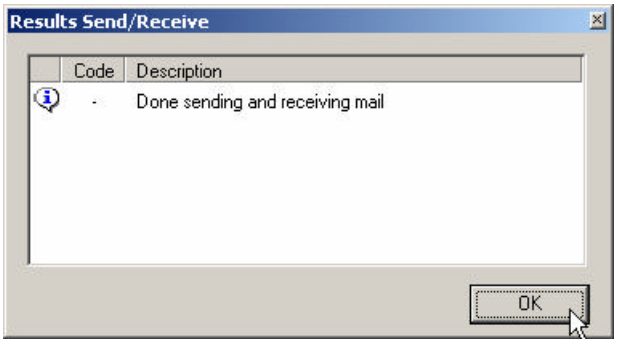


Administrator Tool: configuring contacts to send to and receive from.

Click OK and close the Administrator Tool.

step 7. **Testing**.

In Workstation, press the Send/Receive button. This will send the Send/Receive request to the Mail server. When the Mail server is finished, Workstation will show a dialog with status information. If no errors are reported, the installation and configuration was successful.



Telemedicine: Status information after a successful send/receive.

If you do encounter errors, please turn to the Troubleshooting telemedicine section of this manual. The errors are stored in the Mail Event log in the database.

step 8. **View the event log in Administrator Tool**.

Open the Administrator tool and select Telemedicine-Event log from the Telemedicine section. Errors that occur during sending and receiving mail, as well as successfully sent or received tests and interpretations, are logged here. If no errors are shown in the event log, the Telemedicine installation and configuration was successful. If you do encounter errors, please turn to the Troubleshooting telemedicine section of this manual.

10.3 Other configuration issues

10.3.1. Mail server:

Using the CC MailServer Configuration tool, in the Control panel, the following default settings can be changed:

Folder for temporary mail files:
During the sending and receiving of mail messages, temporary files are created in this directory. As a default, the Windows temp directory is used. When changing this setting, make sure the folder you are specifying exists and can be written to and read from.

Scheduling send/receive:
Sending and receiving mail messages can be triggered manually by pressing the Send/Receive button in Workstation. When the Mail server is continuously connected to the Internet, it might be more efficient to schedule checking for mail and sending out mail on a regular interval. The scheduling interval can be set with a minimum of five minutes.

TCP/IP Port Settings:
See the “Troubleshooting telemedicine” section of this manual. Do not change the TCP/IP settings if not necessary. Only change the TCP/IP port settings in combination with setting the TCP/IP ports in Workstation. Restart the Mail server after changing these settings.

Encryption options:
Mail messages are encrypted to protect the patient’s identity and to secure that medical data cannot be read by anyone intercepting a mail message. The default encryption setting is Triple DES, a well-known secure encryption algorithm. Based on personal preference, it is possible to select any of the other algorithms available. It is not necessary that sender and receiver use the same encryption setting.

Delete non-workstation e-mail messages from Pop3 server (Email only):
When using a dedicated e-mail address for Telemedicine, it is still possible to receive e-mails that are not for Telemedicine. An example of this is the ISP's newsletter or unwanted advertisements often referred to as spam.
With this option checked, these messages are removed from the POP server. The advantage is that the Mail server will only have to scan these messages once, instead of each time it is checking for new mail. This increases the Mail server's efficiency.

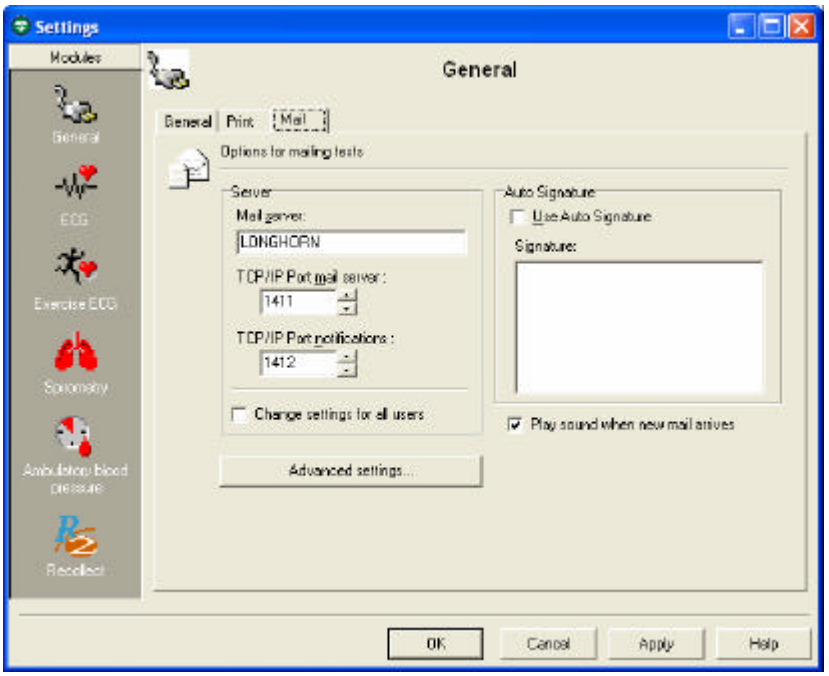
TCP/IP port for direct connections (Direct connection only):
If the default TCP/IP port specified for Direct Socket connection is unavailable, this setting can be changed. However, the TCP/IP port for direct connection on the Mail server(s) acting as Client(s) must be identical to the port used on the Mail server acting as Host. Restart the Mail server after changing this setting.

10.3.2. Mail Client:

In Welch Allyn CardioPerfect Workstation, Telemedicine settings can be accessed by selecting File -> Settings… -> General from the main menu, then select the mail tab. The following values can be changed:

TCP/IP ports:
Only change the TCP/IP port settings in combination with setting the TCP/IP ports in the Mail server. See the previous section 'Mail server' and 'Troubleshooting telemedicine'. Restart Welch Allyn CardioPerfect after changing this setting.

Auto signature:
To automatically sign the interpretations that are sent through mail, select Use Auto Signature and type in the desired signature. These settings are stored per Windows user. This feature is present for backward compatibility. As of version 1.3, full credentials of the interpreting physician will be sent with an interpretation and an auto signature is no longer required.



Telemedicine General Settings

10.4 Troubleshooting Telemedicine

10.4.1. Possible error messages

In this section a few known problems that might arise during the use of the Telemedicine functionality and the possible solutions are described.

No MailServer is active:
Start the Mail server, see Installation and Configuration'.

Unable to start Mail Server:
There can be only one instance of the Mail server running at a time. If the Mail server is already running, trying to run the executable CcMailServer will report the above mentioned error. Check Windows Task Manager to verify that no instance of Mail server is running.
If no other instance of MailServer is running and the server still will not start, it is possible that the default TCP/IP ports used by MailServer are already used by another application or process. Try changing the TCP/IP ports in both workstation and the CC MailServer Configuration. After changing the port settings, restart both workstation and the Mail server. When choosing different TCP/IP ports, view the file "Services" found in the (Winnt/Windows)\System32\drivers\etc folder (Windows 2000/XP).

Workstation doesn't close properly:
Workstation is probably waiting on a time-out trying to contact the Mail server to deregister. Check to make sure the Mail server is running.

Incorrect database version:
Run setup on the computer running the MSDE or MSSQL database server. This will upgrade the database to the required version.

Winsock Errors or time-outs on a LAN:
Make sure Microsoft WinSock Proxy Client is installed and enabled if the LAN is using a proxy server. Also check the Windows Firewall and when applicable a network Firewall, which may block the communication ports.

For other error messages, please refer to the following table.

10.4.2. Mail server error codes

Error codes	Description
100	Unknown error **Action:** Try again, if problem persists, contact Support.
101	A time-out has occurred trying to connect to the SMTP server. **Action:** Try again later; the SMTP server might be down. If the problem persists, check the spelling of the SMTP server name using the CC MailServer Configuration. Also, verify that the network is functioning correctly.
102	A time-out has occurred trying to send email. **Action:** Try again later. If the problem persists, contact the Internet Service Provider (ISP). If you are trying to send an exercise ECG, the email attachment might be too large. Ask the ISP about any size restrictions.
103	Unspecified SMTP error. **Action:** Check the error description in the mail event log; it will give the error text sent by the SMTP server.

104	A time-out has occurred trying to connect to the POP server. **Action**: Try again later; the POP server might be down. If the problem persists, check the spelling of the POP server name using the CC MailServer Configuration. Also, verify that the network is functioning correctly.
105	A time-out has occurred trying to receive email. **Action:** Try again later. If the problem persists, contact the ISP.
106	Unspecified POP error. **Action:** Check the error description in the mail event log; it will give the error text sent by the POP server.
107	A mail message has been received that is sent by an unknown contact. A rejection message has been sent back to the sender. **Action:** if desired. Add the contact using the Administrator tool
108	The mail message that has been received is invalid. It is corrupted or cannot be read. A rejection message has been sent back to the sender. **Action:** Try again, if problem persist contact Support. It could be that the sender is using a different version of the software.
109	An interpretation has been received, but the corresponding test is missing. A rejection message has been sent back to the sender. **Action:** Possibly the test has been accidentally deleted, ask the sender to send the test.
110	A mail message has been received that is sent by a known contact, but the password is incorrect. A rejection message has been sent back to the sender. **Action:** change contact password or let the sender change the password entry
111	A time-out has occurred trying to connect to a host. **Action:** Try again later; the host may be down. If the problem persists, check the contact address of the host using the Administrator Tool. Also, verify that the network is functioning correctly.
112	Contact/Host failed to receive mail message or time-out waiting for reply from host. **Action:** Check the if local user account has writing rights in the temporary directory specified in the CC MailServer Configuration. Check if there is enough disk space to temporarily store mail messages, check if the database server has enough disk space to grow.
113	Contact/Host failed to receive mail message or time-out waiting for reply from host. **Action:** See error 112.
114	Direct socket received unknown command or error. Future use: possibly host and client are using different software versions. Also: connection disconnected by host, the host is going down during a connection **Action:** handle like error 111.

10.4.3. Technical Support

If you have a technical question that you cannot answer with the provided tools, please contact the technical support department or contact your local distributor.

When contacting the Installation & Support department via phone, e-mail or fax please provide the following information:

- Your name, company name, address, phone number, fax number and e-mail address.
- Product serial number.

- Exact product name and version number.
- Type of operating system.
- Type of installation (network or standalone).
- A copy of the Welch Allyn CardioPerfect Technical Support Form:
- Complete description of the problem and the steps to reproduce it. If applicable we would also like to have the exact error message.

See also the Warranty, Service, and Spare Parts on page 3.

I. ECG Checklist and Test Results Form

Use a copy of the form to track your progress through the verification, see 4.2 Functional Verification ECG Recorder.

Model ECG recorder	PRO		MD		Portable	
Serial number ECG recorder						
Type of Computer interface	ProLink	UniLink USB	UniLink RS232	CPCOM PCI	CPCOM PCMCIA	CPCOM ISA
Serial number Computer interface						
Welch Allyn CardioPerfect Software version[1]						
Software Serial number[1]						
Tested by						
Test Date						
[1] You can find the Welch Allyn CardioPerfect software version and serial number in the information tab of the help function						

Patient Cable Verification test					
AHA	EUR	Result (Ohm)	Pass	Fail	N/A
LA	L				
RA	R				
LL	F				
V1	C1				
V2	C2				
V3	C3				
V4	C4				
V5	C5				
V6	C6				
RL	N				

Computer Interface Cable Verification test			
Result	Pass	Fail	N/A

Resting ECG Results Verification						
Parameter	Computer Measurement	Manual Measurement	Tolerance	Pass	Fail	N/A
Heart rate			± 1 BPM			
Calibration pulse	10 mm/mV		± 0,1 mm			
R lead I						
R lead V1						
R lead V2						
R lead V3						
R lead V4						
R lead V5						
R lead V6						

Date :

Signature :

II. MiniHolter Checklist and Test Results Form

Use a copy of the form to track your progress through the verification 4.3 Functional Verification MiniHolter.
***Note**: MiniHolter not sold in US*

Serial number MiniHolter	
Welch Allyn CardioPerfect Software version[1]	
Software Serial number[1]	
Tested by	
Test Date	
[1] You can find the Welch Allyn CardioPerfect software version and serial number in the information tab of the help function	

Patient Cable Verification test					
Color	**Channel**	**Result (Ohm)**	**Pass**	**Fail**	**N/A**
Red	**1 +**				
Black	**1 -**				
White	**2 +**				
Green	**2 -**				

Test	**Condition**	**Expected result**	**Pass**	**Fail**	**N/A**
1	Press the record button briefly	Correct time is displayed. The display switches off automatically after a few seconds			
2	If test 1 fails correct the time[o], remove the batteries and repeat test 1after 6 hours	Correct time is displayed[1]. The display switches off automatically after a few seconds			
3	Format a Recollect memory card with the Welch Allyn Recollect Card Format tool[2]. Fit the card in the MiniHolter and press the record button briefly	The Memory Card symbol is flashing and the MiniHolter starts beeping			
4	Configure the memory card[3] in the Welch Allyn CardioPerfect software for a 2 channel test. Fit the card in the MiniHolter and press the record button briefly	The patient symbol is flashing and the Memory card gives the indication how many recordings can be stored			
5	Switch the ECG simulator on, connect the patient cable to the MiniHolter and press the record button briefly	The patient symbol is not flashing Heartbeat indicator will appear on the display. On every heartbeat there is a beep signal			
6	Press the Record button briefly	The beep signal on every heartbeat will stop. The looping symbol will appear with the 2 in the middle			
7	Press the Record button till a beep signal sounds and the green LED on the front of the Recollect will go on	The Recollect will record an ECG and will store this on the Recollect Memory card. After the set recording duration the Green LED will switch off and the indication on how many recordings can be stored will be one less then on point 4			
8	Unplug the green electrode (2-) from the ECG simulator and shortly remove a battery from the MiniHolter	The patient symbol is flashing and the number 2 is on the display indicating that the problem is related to channel 2			
9	Unplug the black electrode (1-) from the ECG simulator and shortly remove a battery from the MiniHolter	The patient symbol is flashing 2			
10	Measured Heart Rate within ± 1 BPM of the set Heart rate				

[o] For further instructions see WACP MiniHolter manual
[1] If the correct time is not displayed the MiniHolter needs to be send in for service to a Welch Allyn Service center
[2] For further instructions see WACP MiniHolter manual
[3] For further instructions see WACP MiniHolter manual

Date :

Signature :

III. ABP Checklist and Test Results Form

Use a copy of the form to track your progress through the verification, see 4.4 Functional verification ABP device.

Serial number ABP Device		
ABP device Type	ABPM 6100	Mobil-O-Graph
Welch Allyn CardioPerfect Software version[1]		
Software Serial number[1]		
Tested by		
Test Date		
[1] You can find the Welch Allyn CardioPerfect software version and serial number in the information tab of the help function		

Calibration verification					
Pressure mmHG	**Manometer Pressure**	**Device Pressure**	**Difference**	**Pass**	**Fail**
300					
250					
200					
150					
100					
50					

- If using a manometer (mercury column or aneroid gauge) rated at ± 3.0 mm Hg, you will be able to determine the accuracy of the unit being tested to within ± 6.0 mm Hg.
- If using a device (e.g., digital pressure standard) rated at ± 1.0 mm Hg, you will be able to determine the accuracy of the unit being tested to within ± 4.0 mm Hg.

Overpressure verification				
Pressure mmHG	**Manometer Pressure**	**Device Pressure**	**Pass (pressure deflates)**	**Fail (pressure doesn't deflate)**
>300 and <330				

Leakage verification				
Pressure mmHG	**Manometer Pressure**	**Device Pressure**	**Pass (pressure deflates <4 mmHg in 1 min)**	**Fail (pressure deflates > 4 mmHg in 1 min)**
± 150				

Pressure release verification				
Pressure mmHG	**Manometer Pressure**	**Device Pressure**	**Pass (pressure deflates < 3 min)**	**Fail (pressure deflates > 3 min)**
± 150				

Date :

Signature :